THE
VETERINARY JOURNAL

STATE COLLEGE OF AGRICULTURE AND APPLIED SCIENCE
LIBRARY
SEP 14 1932
MANHATTAN
KANSAS

Editor:

FREDERICK HOBDAY, C.M.G., F.R.C.V.S., F.R.S.E.,
HONORARY VETERINARY SURGEON TO HIS MAJESTY THE KING,
OFFICIER DU MÉRITE AGRICOLE (FRANCE),
CAVALIERE DEI SS. MAURIZIO E LAZZARO (ITALY),
HONORARY MEMBER OF THE AMERICAN VETERINARY ASSOCIATION,
PRINCIPAL OF THE ROYAL VETERINARY COLLEGE, LONDON.

Sub-Editor:

GLADSTONE MAYALL, M.R.C.V.S.

AUGUST, 1932.

A SPECIAL PIG DISEASES NUMBER.

THE appreciation which has been expressed in regard to the numbers of THE VETERINARY JOURNAL allotted to special subjects has been so very gratifying, that the October issue will be entirely devoted to pig diseases and to articles connected with the pig industry. Research into the methods which can be successfully adopted by the farmer and pig breeder is badly needed if the pig industry is to be made sufficiently self-supporting in this country to hold its own against its foreign competitors; and the veterinary scientist, both in the laboratory and the field, is the proper worker to undertake the solution of these and other animal disease problems. The whole profession is looking forward eagerly to the forthcoming programme of the newly-formed Agricultural Research Council to find ways and means whereby money may be found and more opportunity given for work on these problems than has been the case in the past; and the Special Pig Diseases Number, as in the case of the recently-published special numbers on the diseases of sheep and poultry, will contain some of the most up-to-date information on this group of diseases which is at the moment a source of great anxiety to this branch of agriculture.

THE MEDICAL PROFESSION AND QUACKERY.

AN article, reprinted from *The British Medical Journal*, which we publish on a later page, illustrates very fully the difficulties which face those who try to help the profession in its efforts to fight against quackery; which gives the human side of medicine quite as much trouble and anxiety as it does the veterinary branch. It is true that they have the protection of the necessary death certificate before burial, which we have not, but except for that—so long as the general public neither differentiate nor care—the medical profession suffer from the same disabilities in regard to this subject as does the veterinary side. One has only

to read the advertisements which are accepted, even by newspapers of good standing, to realise the growth of quackery which the " self-diagnosis habit " imposes upon a credulous public. Even the propaganda work done by the publication of such books as " Secret Remedies " and " More Secret Remedies " and the work of the " Select Committee on Patent Medicines " alluded to in the British Medical Association Journal article, only excited a passing interest on the part of the purchasers of these things ; and the fact that, in purchasing patent nostrums, they paid so heavily merely for drinking water and harmless mixtures, is no deterrent to the purchase of a second bottle—and a repetition order is what the vendor of a patent medicine desires most. The stockowner wastes thousands of pounds in this way, and often by his delay in calling in skilled aid loses many valuable beasts; but his mentality is such that it is difficult to make him see that such a course is truly a "penny wise and pound foolish" policy. The article to which we draw attention will give some consolation to our veterinary readers in that they will see that they suffer in unison with their medical *confrères*.

RESPONSE TO THE ROYAL VETERINARY COLLEGE APPEAL.

At last the appeal of the Royal Veterinary College has fallen on fertile ground, and the result of the efforts of Messrs. The Odhams Press, headed by *The Daily Herald*, appear likely to reach the £25,000 which it originally set out to get. The response to the " slogan " effort has been magnificent, and as *The Daily Herald* can truly be said to be one of the most widely read papers of the people, one can judge from that of the great hold the love of animals has for the rank and file of the British nation.

The effort made has been stupendous, and the response equally so.

With a first prize of £15,000 to look forward to, the slogan lovers have sent in their sixpences by the hundred thousand, and the task of counting out and checking the results has given employment to hundreds of workers.

The Editor of *Sporting Life*, too, Capt. Fowler, is well known as a great animal lover, and the results of his efforts alone in racing circles have already reached the sum of over £5,000, and are still continuing. With the benefit meetings which have been arranged, at his suggestion, by the Greyhound Racing Club and Greyhound tracks, the fund bids fair to reach at least £10,000. The efforts of Capt. Hobbs (of the Tail Wagger Club), added to those of *Sporting Life* and *Horse and Hound* (the other sporting periodical whose kindly interest recently raised over £5,000 for the same cause) will for all time have the credit of having done this for British veterinary science at a time when money seemed almost impossible to get, and during the years of the worst financial stringency that the world has ever known.

The effort they have put into things has enabled the rebuilding of the Royal Veterinary College to commence at last, and now it remains for those in control to give of their best to design and equip a set of hospital, laboratory, museum, and other necessary teaching buildings, which will be a monument for all time, and be worthy of the British Empire.

XUM

General Articles

SOME ASPECTS OF SHEEP SCAB CONTROL.

By A. W. NOEL PILLERS, F.R.C.V.S.
Chief Veterinary Officer to the City of Liverpool.

AN account of the difficulties in sheep scab eradication in Great Britain, such as that by Simpson in THE VETERINARY JOURNAL for April last, is not cheerful reading. The inspired effusions which appear from time to time in the agricultural press on the lack of sympathy and negligence of sheep owners are no better. A new sheep scab order, and its accompanying circular letter, are often just as bad. They create a feeling that one has before one the speech for the defence in a hopeless case of guilt. In Simpson's stimulating article one can discern an early growth of the same feeling. If one has not been actively engaged over long periods in the control of a disease, and yet writes about it, one is apt to be regarded as an arm-chair critic. Whilst this to a certain extent is a correct outlook, it must not be forgotten that there is also a deal of truth in the saying that the onlooker sees most of the game.

It must be admitted that sheep scab is not yet under control, and that even if the decline shown in recent years continues it will be some time before it is eradicated. Although there are many aspects of the disease which seem to afford opportunities for discussion, it is proposed to mention only a few here in order to comply with a request from the Editor.

Sheep scab is not defined in existing legislation, but in the Introduction to the "Handbook of Diseases of Animals Acts and Orders thereunder" there is an account which appears to be given to assist lay and legal minds. Thus:

Sheep Scab.

"*Definition.*—A disease of the skin caused by certain members of a class of small insects known as acari."

"*Animals Affected.*—Scab is popularly known in animals other than sheep as mange. The parasites which cause mange belong to the same family as those which cause scab, but they are a different variety. In sheep three forms of scab are met with. Psoroptic scab, due to the "*psoroptis communis*," is the most common form found in sheep. Sarcoptic scab, or mange, due to the "*sarcoptes scabei* var. *ovis*," occurs in sheep, but it is rare. Symbiotic (scab) mange is also known."

"The sarcoptic parasites will live on other animals and on human beings. They cause severe symptoms; the other parasites only live on man for a few days, causing temporary irritation."

It would be better to give the name of the acari which cause sheep scab, instead of becoming entangled in general terms such as "certain members of a class." Anyway, acari are not insects by any stretch of imagination. Many

veterinary surgeons regard sheep scab as the disease caused by *Psoroptes ovis*. If the other forms due to *Sarcoptes ovis* and *Chorioptes ovis* are to be included, the legislation ought to say so. All three mites are mentioned either directly or indirectly in the above extract; different systems of nomenclature are used, and there are mistakes in spelling. Extraneous matter seems to have been introduced, and the value of the words "animals affected" seems doubtful. Advisory Leaflet No. 103, which was issued in March this year, makes it perfectly plain that there is only one species of mite concerned in sheep scab, viz., the psoropt.

The Sheep Owner.—Several diseases of animals have been stamped out in this country, and sheep scab has been cleared from several of the colonies. To blame the attitude of certain sheep owners as being one of the most important factors in the unsuccessful campaign against the disease seems to reflect rather severely upon a special class in a special country. It is the duty of the eradicators to concentrate upon any apparent weaknesses and remove them.

Imported Sheep.—The Report of the Proceedings under the Diseases of Animals Acts for 1930 shows a steady decline in the prevalence of sheep scab. Thus:

Year.	Counties affected.	Outbreaks.
1928	69	746
1929	61	666
1930	46	478

Thirty-nine cargoes of sheep from Ireland, and six from the Isle of Man, were found to be affected at ports of landing. Although dipping is carried out at once, officials of certain counties blame these islands for some of their outbreaks. They argue that many animals may be passed through landing places in the pre-clinical stage. If there is spread from this source, stronger measures could be enforced at the ports.

Approved Dips.—On December 31st, 1930, there were 300 approved dips, of which 216 contained tar acids, 81 were arsenical, and 3 sulphide. These were retailed under 1,038 titles and names. Of 63 approved dips sampled during the year 7, or 11 per cent., proved unsatisfactory when examined by the Government chemist. If a similar state of affairs is general, then about 11 per cent. of dipping operations would be unsatisfactory from a chemical point of view alone. Many members of the profession hold that chemical examination alone is not reliable in estimating the acaricidal power of all dips. From time to time I examine sheep scab scrapings sent in by practitioners who often say that the flock has recently been twice dipped under the official eye a few weeks previously. Some of these scrapings contain living psoropts. In such cases I am assured that their presence is not due to re-infection, so that it would appear to be due to the dip used, or its method of application. It is a clinical experience in the treatment of psoroptic mange of the horse that complete clipping and washing, followed by two complete dippings at an interval of eight days in certain prepara-

XUM

tions which are approved for sheep scab, does not always effect a cure. It is said of many sellers of approved dips that they use their dips at double strength when dipping their own sheep. Surely there is plenty of room for the activities of the vested interests of dip makers besides insisting on a place in the sun in such a serious matter as the treatment of a scheduled disease.

Lessons from History.—In none of the countries which have controlled sheep scab can I find anything approaching the number of approved dips that we have; instead of 300, it is nearly always nearer three or four. Those seriously interested will find much useful information in the reports of countries where the disease has been stamped out.

Fencing.—There is no doubt that the difficulties of control on rough hill land or mountains are very great. Many officials maintain that provisions to prevent the straying of sheep from one estate, one tenancy, or one county to another, are as essential here as in the case of holdings in the valleys and plains. I have seen years of worry and extra costs cut short by fencing out a mountain boundary by means of pointed quarter-posts, and three strands of wire. In certain parts old beliefs still hamper progress; such an one is the case of old rams "walking the boundary," and so keeping off intruders. No explanation is, however, offered as to what happens to rubbing stones or posts when an affected neighbour crosses the boundary when the flock is at the other end of the range.

N.V.M.A. Committee.—The weaknesses of the present position are well known to many members of the profession, and there appears to be every reason to hope that a small committee of the N.V.M.A. could soon draw up a scheme which would be of the greatest value to the sheep industry and the central authority. Such a committee might consist of a keen and experienced superintending officer of the Ministry, with a divisional officer of some years' experience, then a whole-time officer of a county which is troubled by the disease, and, finally, a general practitioner who does a deal of sheep scab work. If a chief constable and a sheep owner could be co-opted, all sides would be represented.

THE USE OF CHLORAL HYDRATE IN GENERAL PRACTICE.

By C. S. SHAWCROSS, M.R.C.V.S.

Altrincham.

CHLORAL HYDRATE is well known as one of the most useful drugs in the surgery for a variety of cases, and would no doubt be more used if its administration were attended with less risk. My only object in writing this article is to call attention to cases in which the drug might be administered *per oram*, or by rectal injection, or taken by the patient voluntarily in drinking water or sloppy food. The use of the stomach tube in the administration of chloral hydrate is not always satisfactory in restive animals, and where possible nasal hæmorrhage is likely to

interfere with subsequent anæsthesia. Intravenous injection of chloral is not always practicable, as the type of case requiring treatment with this drug is often too rough to allow one to use sufficient care.

Case 1.—Milk fever with meningitis; temperature 109. Cow extremely rough, bellowing, grinding teeth, respirations and pulse very rapid. Chloral hydrate, oz. ii, mixed with hot water and treacle, was injected per rectum, and cold-water cloths applied to the head. In fifteen minutes she went quiet and sleepy, and the temperature had dropped to 106. The udder was now inflated, and a hypodermic injection of Calcium Sandoz given. In eight hours the cow was up and eating, and made a complete recovery. I have found chloral hydrate given as above per rectum is extremely useful in all cases of meningitis when it is too dangerous to give a drench.

Case 2.—Recently I was attending a case at a farm, when a cow which was being brought up from the field jumped a barbed-wire fence, and tore one teat to ribbons. Amputation of the teat was decided upon, and this was done in a hurry, as hæmorrhage was severe. The base of the teat was ligatured, and the teat severed below the ligature. The cow was so wild that it was feared that the owner would be unable to remove the ligature the next day without casting the cow, and as she was just at calving, this was undesirable. Two ounces of chloral was left, to be given in a pail of water half-an-hour before he wished to remove the ligature. This was done without disturbing the cow in the least. Whilst still under the influence of chloral she both calved and cleansed. The usefulness of chloral in alleviating the pain of colic without interfering with peristalsis is generally recognised, and the above case proves that the labour pains of parturition are not impaired by its use.

Case 3.—A horse which had turned savage and for two days no one had been able to enter the box with food or water. One ounce of chloral was dissolved in a pail of water and lowered into the box with a rope. The horse greedily drank the water, and fifteen minutes later quietly submitted to the adjustment of a bridle. He was led a distance of seven miles quietly, and was then slaughtered for lion food.

Chloral may be given in the above manner to both horses and cattle if water has been previously withheld, and a number of minor operations may be performed on restive animals prepared in this way without using much restraint. Chloral may also be given in this way as a preliminary to complete anæsthesia, and obviates the restlessness usually associated with chloroform when the muzzle is put on a horse in the standing position. In eversion of uterus in cows I usually give a drench of one ounce of chloral mixed with treacle and water as a preliminary to returning the uterus. It not only prevents shock, but makes the cow easy to handle, and after reduction of the uterus the cow can be propped up in a comfortable position, and left half asleep for four or five hours, after which she usually gets up little the worse for her experience unless there has been serious damage to the uterus.

XUM

TUBERCULOSIS IN CATTLE—ITS OCCURRENCE IN NORTHERN NIGERIA.*

By G. NORMAN HALL, M.R.C.V.S.

Pathologist to the Veterinary Research Laboratory, Vom, N. Nigeria.

TUBERCULOSIS amongst cattle owned by natives in Africa appears to be of extremely rare occurrence, and as far as Nigeria is concerned, I have been unable to obtain any reference to a previous occurrence of such an infection amongst indigenous cattle of this country. Recently in the Cameroons the disease was diagnosed amongst a herd of cattle, and the source of infection was traced to a bull imported from Europe. The infection soon spread amongst the herd, and the conditions under which they were housed aided to a rapid dissemination amongst the stock, and the whole of the infected herd was eventually slaughtered as the most economic method of dealing with the disease in a country presumed to be free from bovine tuberculosis.

In the Veterinary Research Laboratory, Vom, where about seven hundred post-mortems are made each year on bovines, the disease has never been previously diagnosed. Cases of tuberculosis have never been reported from any of the abattoirs in this country, which are under medical or veterinary supervision. Suspected material was recently forwarded from Lagos, but proved to be negative.

The rare occurrence of this infection in this country makes the case which recently came to my notice of particular interest, and possibly of some economic importance.

A native ox belonging to the Government stock farm at Vom was sent to the laboratory for a post-mortem examination. The animal had died without showing any symptoms indicative of any particular infection. A post-mortem examination was made and revealed an acute and typical infection of tuberculosis.

The following were the post-mortem findings :

Thoracic cavity.—Contained about a quart of blood-stained fluid. *Right costal pleura.*—Two large masses of small tubercles, grape-like in appearance, adherent to the costal pleura. The tubercles varied in size from a millet seed to a large pea. The tubercles were pedunculated, firm in consistence, and on section yellow-grey in colour. *Left costal pleura.*—Much thickened and roughened, but no grape-like masses present.

Lungs.—Distended. Right lung adherent to diaphragm. Marked emphysema in anterior lobe of left lung, no adhesions. On palpation of the right lung, numerous tubercles in size from a millet seed to a small pea could be felt. Many of the tubercles were projecting above the surface of the lung, especially in the posterior lobe, where the tubercles were most numerous. On section the posterior lobe was much congested. The bronchioles were distended, and on pressure a frothy liquid exuded. The middle lobe and the anterior lobe were in a state

* From the *West African Medical Journal.*

of red hepatisation and acute congestion. The left lung showed changes similar to the right lung.

Glands.—The mediastinal glands were the size of a hen's egg. On section they were firm, and of a yellow colour, with an acute hæmorrhagic area in the centre. The bronchial glands showed the same appearance to the naked eye. There were no visible lesions of tuberculosis present in either liver, spleen, or kidney, and the infection appeared to be solely confined to the thoracic cavity, principally the posterior lobes of both lungs, the bronchial-mediastinal glands and the pleuræ. Smears from the glands revealed the presence of acid-fast bacilli. Fresh material from the bronchial and mediastinal glands was emulsified in sterile saline, and inoculated into guinea-pigs subcutaneously and intraperitoneally. An attempt was also made to obtain a culture from the infected gland. Tubes of various culture media were inoculated, but all attempts to produce a growth from the original infected gland failed, although smears from the gland showed numerous acid-fast bacilli.

Animal inoculations.—It is not intended to describe and compare in detail the post-mortem lesions seen in each of the inoculated animals, for in nearly every case the lesions, as a result of inoculation of infected material, were typical of such infections. In this particular instance the question of comparison of the virulence of this strain with other strains does not arise. Hence, in the following table the letter G is used to indicate a generalised and advanced infection, while the letter I indicates the infection of certain organs only, and not a generalised infection.

Animal.	Source of infection.	Method of inoculation.	Survived.	Result.
Guinea-pig 1	Mediastinal gland	Subcutaneous	38 days	I
„ „ 2	„ „	Intraperitoneal	Died (other causes)	—
Rabbit 14	Gland, guinea-pig 1	„	94 days	G
„ 10	„ „ 1	„	56 „	G
Guinea-pig 3	„ „ 1	„	27 „	G
Fowl 1	„ „ 1	Subcutaneous	Killed after 4 months	nil
„ 2	„ „ 1	Intraperitoneal	„ „ „	nil
Guinea-pig 7	„ „ 2	„ „	21 days	G
Rabbit 8	„ „ 2	Subcutaneous	Killed after 18 days	I
„ 12	„ „ 7	Intravenous	29 days	G

Smears were made from the infected organs of the animals which died and from rabbit No. 8 which was killed, and tubercle bacilli were found in every case to be numerous.

Growth on media.—From bronchial and mediastinal gland of the infected bovine, primary cultures proved negative. Infected material from the following animals, guinea-pig No. 1 and guinea-pig No. 2, rabbit No. 10, and rabbit No. 14,

XUM

when inoculated on Dorset's egg medium, glycerine agar, glycerine broth, and glycerine potato, all proved negative. The majority of the cultures after prolonged incubation remained sterile. After numerous efforts, a delicate growth was at last observed after the inoculation of infected material from guinea-pig No. 7 (which died as a result of a generalised tuberculosis); and from the internal organs and glands with caseous material, teeming with tubercle bacilli, a slight growth was obtained. From this growth on Dorset's egg medium a subculture was made on various batches of fresh medium, and at the time of writing there is indication that some of the subcultures have commenced to grow, but the growth is most meagre.

Morphology and staining characters.—The organism when observed from the smears taken from the bronchial and mediastinal glands of the infected ox were numerous. In the smears from the culture media and from material from the infected guinea-pigs and rabbits, the organisms appeared singly, in clumps, and in pairs. Both short and long forms were numerous, while the typical curved forms, so frequently associated with organisms of the human type, were not observed, although some of the bacilli showed a tendency to be slightly curved. The long slender forms so characteristic and commonly met with in material from human sources were by no means a distinctive feature of this strain. When stained with Ziehl-Neelsen, the organisms readily took on the fuchsin colour and proved to be strongly acid-fast, while the irregular staining associated with the human type was not frequently observed.

Discussion.—The case is of interest, for it is, as far as I have been able to ascertain, the first occasion that it has been definitely proved that an ox has been infected naturally with tuberculosis in Northern Nigeria. The question arises as to whether the source of infection was of human or bovine origin. When it is considered that tuberculosis is by no means rare amongst natives, and it is not an uncommon practice to house calves soon after birth in the same quarters as those occupied by the owners at night, it is possible that the source of infection might be of human origin. This view is further supported by the fact that cases of tuberculosis amongst cattle have never been observed, although vast opportunities have occurred for such cases to be diagnosed both by the officers in the field, and as a result of numerous post-mortems at the laboratory during the past few years.

In the case of the outbreak in the Cameroons previously referred to, the source of origin was traced to a bull imported from Europe, and the infection rapidly spread to the rest of the herd.

In the ox, the subject of this note, as far as can be ascertained, there is no history which throws any light on the source of infection, and for some considerable period the beast had been grazed with cattle apparently free from infection, on the stock farm.

At present, three types of tubercle bacilli are recognised; human, bovine and avian. The bovine type produces a severe pathogenic reaction on cattle, while the human type is only slighly pathogenic.

In this case the pathological anatomical changes were most characteristic of the bovine type, miliary tubercles invading the lungs, while the most marked infection occurred in the posterior lobes together with the typical grape-like formation adhering to the pleura are of common occurrence in cases where the lesions are confined to the pleural cavity. The classification of the three types is, however, principally based upon their pathogenicity, not only upon their natural host, but also upon the infection and degree of virulence on other animals. On microscopic grounds alone, morphological differences have been observed by various workers, and also on culture media certain changes are peculiar to one type, and not to the others.

On morphological grounds the organisms resembled more the bovine type, for short and stumpy forms predominated, while the long slender and curved forms with irregular staining were not a characteristic. There is not yet sufficient evidence to show the differences on various media, for this particular strain was most strongly dysgenic on all media on which growth was attempted. The above two methods afford some means of differentiation ; but it remains for the inoculation of animals to decide the final differentiation, a method by no means perfect, for so many factors have to be considered, since the virulence of the organism and the resistance of the beast both influence the degree of infectivity, but it is the best means at present at our disposal. The bovine type is far more virulent than the human type when inoculated into laboratory animals, and diagnosis is based on a comparative infectivity of the various strains on inoculated guinea-pigs and rabbits.

In the above experiments the longest period a guinea-pig survived after inoculation was thirty-eight days, and the shortest was twenty-one-days. The rabbit, which is comparatively only slightly susceptible to the human strain, died as a result of generalised tuberculosis with lesions typically associated with the bovine type, and the inoculated animals only survived ninety-four, fifty-six, and twenty-one days, while in the case of rabbit No. 8, which was killed after eighteen days, well-marked lesions had developed. The fact that rabbit No. 14 survived ninety-four days after an intra-peritoneal inoculation may possibly be explained by natural resistance, for rabbit No. 10, inoculated with material from the same guinea-pig and by the same route, only survived fifty-six days. The fowls, after four months, were destroyed, and all the organs were in a perfectly healthy condition, and there was no suggestion of the semblance of lesions even at the site of inoculation.

The results of the inoculation, and the lesions produced, point to the organism being of bovine type. The economic importance of this one case yet remains to be proved, but it is necessary for every officer in charge of abattoirs to maintain a strict vigilance, for the disease may be more widespread than has been considered in the past. In this connection, it is important to note that according to the Annual Medical and Sanitary Reports of Nigeria for the years 1916, 1917 and 1918, cases of tuberculosis of cattle and pigs were diagnosed in Lagos, fifty-four

XUM

being found infected in 1917, and eighteen in 1918. I am unaware of the number, if any, which have been diagnosed since the latter year.

As a result of the large number of cases diagnosed during 1917, the drop to a third of that number in 1918, and a reference only in 1916 to the occurrence of the disease, I am inclined to think that if some of the infected cases could only have been traced it would have been found that possibly a great number of the infected animals originated from a common source. It was known that in 1916, cattle in the Cameroons were infected with tuberculosis, and it is probable that a high percentage of pigs were also infected. Pigs are not reared in the north, hence the infected animals did not come from Northern Nigeria. There is the possibility of the northern cattle contracting the infection after arrival in Lagos, but the animals would not be kept sufficiently long prior to slaughter to allow time for the development of well-marked macroscopic lesions, so it is more probable that the animals found infected, if they came from the north, were infected prior to their arrival in Lagos.

From Southern Nigeria numbers of animals are also annually exported to Lagos for slaughter, and the possibility of infection existing there is not remote, and as pigs are also reared, it is possible that some of the animals also harbour the infection. If Southern Nigeria were badly infected, the disease would come to light frequently, and be observed in the daily routine of meat inspection. The same applies if Northern Nigeria were infected to any extent, but in this case veterinary officers, who are stationed in every important cattle centre, would have the opportunity of diagnosing the disease.

The high reduction of positive infections from 1917 to 1918, and the comparative rarity of cases since that date, suggest the possibility that no small percentage of infected animals during that period arrived from the Cameroons. It would be of great interest if in the future, when cases of tuberculosis are diagnosed in Lagos or elsewhere in the Colony, the area from which the cattle were exported could be traced through the buyers.

REFERENCE.

Manley, F. H.: "A Note on Tuberculosis in Tropical Africa." *Journ. Comp. Path. and Therap.* December, 1929.

THE SPASMS OF ELECTRICALLY STUNNED ANIMALS IN THE LIGHT OF BIOLOGICAL RESEARCH.*

By PROFESSOR M. MULLER.

Munich.

IN this journal* of March 10th, 1929, page 89, No. 4, I have already described the principle of instantaneous electrical stunning of animals for slaughter as being analogous to the condition found in human beings who, as a result of epileptic symptoms, are suddenly rendered unconscious and insensitive. I therefore defined electrically produced instantaneous stunning of animals as an epileptic

* Reprint from the *Deutsche Schlachthof-Zeitung*, 1932, No. 1.

condition. This gave the key to the understanding of the process of electrical stunning from a biological point of view. It has been known for many years that human beings who are suddenly overcome by this curious anomaly of life are completely unconscious and insensitive in spite of the appearance of tonic-clonic cramp conditions. Those who experience these peculiar disturbances of their normal course of life have, after the fit has passed, no knowledge of what has happened in their body, even although in their case spasms have been observed which give the impression that the persons concerned are suffering pain. Owing to its mysterious nature, this condition, which has long been known to befall human beings and animals, went under the name of " morbus sacer," the " sacred disease," of which hitherto no natural explanation had been found. This " fit " epilepsy was supposed to be caused by a demoniacal spirit, who suddenly took possession of the person for the time being, and then left him again. The nature of this condition remained a mystery for a long time. But the opinion recently voiced by Lieben in this journal (1931, p. 316), that in spite of hundreds of years of research medical science still does not know what epilepsy is, cannot be regarded as being correct.

It was quite a comprehensible desire of biological research to bring light into this curious darkness, to find out how and by what means this suddenly appearing condition of complete unconsciousness and insensitiveness accompanied by tonic-clonic cramp arose. On human beings themselves a solution could not be found by experimenting. All that was proved again and again from human beings was that in this condition, which was caused by some disturbance, the person was unconscious and insensitive. By experiments on animals, therefore, an attempt was made to discover how these fits of complete unconsciousness and insensitiveness in combination with simultaneous cramp conditions could be produced.

These causal investigations on animals were chiefly carried out about a hundred years ago. They began with the assumption of disturbance of the blood circulation in the central nerve system. Travers, Marshall Hall, and Astley Cooper (1836) recognised the appearance of convulsions in anæmia of the brain. In particular Kussmaul and Tenner (" Untersuchungen zur Naturlehre des Menschen und der Tiere," III, 1857) showed that the cutting off of the arterial blood stream to the brain in animals produces cramp and unconsciousness. On this discovery was based the explanation of the appearance of an epileptic fit in a human being.

These experiments on animals are also the foundations for explanation of the electro-spastically produced unconsciousness in animals for slaughter, for since instantaneous electrical stunning cuts off or obstructs the blood stream from the brain in another way—without bleeding—the process is based on very long-established physiological facts. The knowledge of them explains the principle and mechanics of electrical stunning. Kussmaul and Tenner were aware that a sudden and acute arterial " active " anæmia of the brain results in coma and cramp conditions in animals. In their experiments on animals they stopped

XUM

or compressed the four arterial vessels leading to the brain. When the arterial stream was reopened the cramp and unconsciousness disappeared again. On the one hand, therefore, in these experiments on animals the result was unconsciousness and cramp, as in the case of animals for human consumption rendered spastic and unconscious by means of an electric current; on the other hand, it was proved that consciousness was maintained as long as the brain was supplied with arterial blood.

In the animals the attacks always consisted of coma, that is to say complete loss of consciousness and sensitivity, and cramp. The latter was at first tonic, then clonic, the clonic conditions being recognised particularly by severe cramping of the muscles of the extremities of the animals. Then the cramp symptoms gradually disappeared. The whole symptoms were therefore the same as those found in electrically stunned animals for human consumption.

By electrifying the sympathetic nerve of the neck, Kussmaul and Tenner also obtained on the side of the non-obstructed carotid a general cramp condition and coma in animals. Kussmaul and Tenner's causal investigations on animals also provided the experimental proof that in the case of the instantaneous cramp condition produced by electrical stunning the loss of consciousness and sensitivity is also due to arrested blood circulation in the brain. From their experiments on animals Kussmaul and Tenner concluded that epileptic symptoms in human beings consist in a functional disturbance of the central nerve system, which must be caused by the effect on the vasomotor nerves, or on their centres in the medulla oblongata. As regards their experiments on animals, the authors emphasise that the unconsciousness and insensitiveness of the animals to pain is due to disturbance of certain parts of the cerebrum hemispheres. The rapid arterial anæmia involves on the one hand the cerebral cortex as the organ of consciousness, while on the other hand the anæmia of the *pons* and *medulla oblongata* necessitate the appearance of spasms.

If therefore we apply these discoveries of Kussmaul and Tenner to the process of the electrical stunning of animals destined for slaughter, we see that the application of the electric current through the medulla oblongata (*i.e.*, behind the ears, on the neck), and also from the neck to the forehead, or transversely or diagonally through the brain, but producing anæmia of the brain, causes symptoms such as already discovered by Kussmaul and Tenner in their experiments on animals—complete unconsciousness and insensitiveness (coma) accompanied by tonic-clonic cramp. When the current supply is cut off the cramp continues for some time, whereupon consciousness and feeling return if the animals are not bled in a comatose condition. Consequently the explanation which I have given independently of these basic facts, namely, that the effect of the electric current on the brain, as used in the instantaneous stunning of animals for slaughter, produces an epileptic fit in the animals, is absolutely correct.

The statement that electrically stunned animals are excited and conscious, and are not stunned, is, therefore—apart from the obvious condition of complete

XUM

unconsciousness and insensitiveness when the current is switched off—absolutely contrary to the facts, which can be proved by experiment.

According to Nothnagel (Volkmann's Collection of Clinical Lectures and Vischow's Archive 44) the unconsciousness in an epileptic fit is caused by excitation of the vasomotor centres of the oblongata resulting from cramping of the brain vessels. The spasms immediately following he attributes to the excitation of a cramp centre in the *pons*. As I have already mentioned in this Journal (1931, page 317), the setting in of unconsciousness, owing to anæmia accompanied by convulsions, can be observed very well by the application of the electric current to the brain of turkeys.

E. Hitzig and G. Fritsch, Ferrier, and, later, Horsley and Beevor, confirmed the appearance of spasms during unconsciousness by the electrical excitation of certain motor sections of the cortex of the cerebrum. The series of experiments by H. Munk and his followers, Danillo and Ziechen, Albertoni, Frank and Pietres, Bubnoff and Haidenhain, Unverreicht, Rosenbach, and others, provide information concerning the regions the excitation of which produces spasms in unconscious animals.

According to the investigations of H. Munks and his followers, the application of a low electric current to a motorially excitable region of the cortex causes an isolated clonic convulsion of the corresponding muscular region. With a stronger excitation the cramp condition spreads according to the anatomical order of the individual excitable fields on the cortex of the brain. These conditions of cramp during unconsciousness also occur in certain phases of morphine narcosis, and other chemical methods of stunning. According to Munk an increased reflex excitability accompanies anæmic unconsciousness. When the activity of the cerebrum is undisturbed a restraining influence is exerted on the reflex centres in the *medulla oblongata*. It is therefore false to conclude that when on application of the electric current to the central nerve system a condition of cramp can be observed, consciousness is present. The electrical impulse affects the vasomotor centre, which normally keeps the arterial vessels in a certain condition of tension (tonus). The stronger impulse produced in electrical stunning necessitates, owing to the cramping of the vessels, a disturbance in the blood circulation in the cerebrum which results in loss of consciousness. On the other hand, the anæmia in the medulla oblongata causes tonic-clonic cramp to set in owing to the elimination of the reflex restraining influence exerted by the brain. Indeed, the extirpations of the brain first carried out by H. Munk and Luciani proved that the cramp which appears during unconsciousness is favourably affected by the elimination of that restraining influence of the brain.

In the present article it is impossible to go into all the most important causal investigations regarding the appearance of spasms in animals which have been rendered narcoleptic. Those who wish to form a correct opinion about the action of electric current on the central nerve system of animals for slaughter, however, must familiarise themselves with the results of the biological research. False

XUM

conclusions and doubts which are contrary to the actual verifiable facts must be given up, since the connection between the spasms and coma caused by anæmia has been established. I should not speak in favour of electrical stunning for the purpose of humane slaughter if the complete unconsciousness and insensitivity of the animals so treated were not an actual fact. Indeed, since the reaction of the animals to the electric current and the appearance of spasms can be proved so conclusively, doubts merely denote lack of biological knowledge of the subject.

Amongst further experimental investigations which explain the nature of the epileptic condition, we should note here those of Magnon, Albertoni, Frank and Pitres, Balogh, Vulpian, Eulenburg and Landois, Bartholow, Bubnoff and Haidenhain, Ziehen, Binswanger, Prus, and others.

From a physiological point of view the symptoms which appear in anæmia of the brain are to be defined in such a way that coma and spasms are the symptoms resulting from an interruption of the blood supply to the brain. Reversely, when the blood supply to the brain is interrupted by electrical excitation, coma sets in simultaneously with the spasms. The presence of the condition of complete unconsciousness and insensitivity in animals which have been rendered narcoleptic and electro-spastic owing to the application of the electric current to the brain, has been further proved in a number of experiments in connection with the action of electrical currents on animals. I shall, however, reserve the discussion of these investigations and observations for a later study of the action of electric currents on the vital functions according to voltage, intensity, and current. A. Weinberger will also report on this subject in an article on electro-technique, which is to appear shortly in this journal.* For the unconsciousness and insensitiveness of the higher animals to which the electric current has been applied, however, the following general rule can be adopted. Every current which is not fatal has a stunning effect if the body is connected in a circuit in which the current is of sufficient strength to produce spasms in such a way that at least one pole is applied in the vicinity of the brain.

If both poles are applied away from the head, spasms are produced while consciousness is retained, provided that the current is strong enough in itself to cause electro spasms, and, on the other hand, is not so high as to inhibit the action of the whole central nerve system, and thus destroy the vital powers of the animal's body.

If when applied to the brain a spasm-producing current immediately results in coma, then weaker currents which cause no decided muscular spasms produce only a soporific, sleep-like condition, as Leduc demonstrated in the experiments which he carried out on himself. Here belong the experiments of Mayr, Wenger, and Zimmermann on dogs, in order to prove the question of the extent to which the process could then be used for operative purposes. For surgical work the spasms are, of course, undesired symptoms. It was just because in the experiments which Leduc had made on himself the current supply was not increased until electro spasms appeared, that he was not rendered completely unconscious,

* *Deutsche Schlachthof-Zeitung.*

XUM

a fact which, as we know, he regretted. This must also be comprehensible to those who from Leduc's experiments always try to assert the opposite of what Leduc wished to know, namely, that by the application of an electric current to the bodies of human beings and animals it is possible to produce unconsciousness and insensitiveness. That on the application of a current of insufficient strength a condition of excitement is first produced is comparatively self-evident. Leduc emphasised expressly that as soon as the spastic condition sets in, the animals on which he experimented were completely unconscious. In his first lecture on the production of sleep, and of general and local anæsthesis by electric currents, at the second International Congress for Medical Electrology and Radiology in Berne in 1902, he attributes the spasms which appear during unconsciousness to the excitation of the motor zones in the central nerve system.

Tonic-clonic cramp also sets in when the animals are stunned by shooting. From these spasms no one infers the presence of consciousness, even though with this method of stunning a reappearance of consciousness after the spasms have ceased can also be frequently observed. When Junack rejected the shooting method of stunning he also took exception to the appearance of spasms, and condemned the process because of these symptoms without going further into the nature of the symptoms. The appearance of tonic-clonic spasms, as observed in cases of human brain injuries, led to the belief that epileptic fits in animals can be traced directly to the same cause, *i.e.*, injury or concussion of the brain. The case of an attempt at electrical excitation of the brain of a human being with an injured skull is also present in literature, but the explanations of the appearance of spasms and coma in an epileptic condition do not apply, as trauma is lacking. In epilepsy the only unknown factor of importance is the impulse which releases the excitation of the vasomotor centre with subsequent anæmia.

When, after the animal has fallen down unconscious after the use of the humane killer, the slaughterer strikes a number of heavy blows on the skull before bleeding, this is done in order to release the condition of cramp which has set in when the animal became unconscious. It is only after a number of very heavy blows have been given, and the brain has been deeply smashed, that the spasms caused by the shooting appear. Otherwise the non-appearance of the spasms cause a stoppage of the blood in the veins, and this results in incomplete bleeding. This striking of blows is often preferred to the insertion of an elastic cane through the hole made in the forehead by the shot. Here also can be observed reflex movements which have a gruesome effect on the biologically uninitiated, and which are often falsely construed as indicating sensitivity of the stunned animal to pain.

The purpose of the introduction of a stick into the brain, however, is to disturb the *medulla oblongata* from the opening in the skull made by the shot. At first the reflex movements become stronger, then when the medulla is affected the condition of cramp present in this method of stunning, in spite of unconsciousness, is released, which enables better bleeding of the animal. With an excited and

XUM

conscious condition that has nothing at all to do, neither here nor in electrical stunning.

The result of the biological investigations just described, together with the reports of the conditions found in electrically-stunned animals, can be summarised as follows: (1) Every interruption of the blood supply to the brain in a manner which interferes with metabolism results in unconsciousness accompanied by tonic-clonic cramp symptoms. (2) In the electrical stunning of animals for slaughter, the muscular cramp which sets in immediately the circuit is closed produces simultaneously unconsciousness and insensitiveness owing to anæmia of the brain. When the animal is struck in a comatose condition for bleeding purposes, corporeal death is brought about in a manner imperceptible to the animal, without the return of consciousness.

POLYNEURITIS IN FOWLS: A NOTE ON THE OCCURRENCE OF THE DISEASE IN NORTHERN NIGERIA.

By G. NORMAN HALL, M.R.C.V.S.

Pathologist to the Veterinary Research Laboratory, Vom, N. Nigeria.

In view of recent publications which have described investigations in connection with fowl paralysis, and which have demonstrated the economic importance of the disease and the heavy loss which it causes amongst poultry, the following notes may be of some interest, particularly as the disease was diagnosed for the first time in Nigeria towards the end of 1929 amongst an imported pen of fowls from England, while recently a second case was observed in a native-bred fowl.

In a publication in this Journal, McCulloch records an epidemic of the disease under the name of " polyneuritis gallinarum," and claims to have cured infected birds by feeding of fresh lettuce. He further states that he was informed by Johnson that the latter had cured birds by feeding them with ground-nuts. In a more recent article, McCulloch refers to the outbreak again under the name of " leg-weakness of chickens," and was of the opinion that the birds imported from England, being deprived of grass, and living on guinea-corn and pearl millet, both products deficient in certain vitamins, was the main factor causing the disease. The outbreak described by McCulloch was in a pen of English birds, and as these birds are generally confined to a run, and do not get the opportunity of roaming and obtaining a variety of diet, which the common native fowls have access to, the condition which he described can be accounted for, and is not infrequently observed in birds in confinement.

Fowl paralysis was quite recently for the first time recorded as occurring in the British Isles by McGaughey and Downie (1930), while in South Africa, Thomas (1928) recorded its occurrence. The disease had been recorded previously by a few workers under various names. Marek, in 1927, described it in Austria, and called it polyneuritis. Walley and Winkler Jones observed it in Holland, and

XUM

described the condition as neuromyelitis gallinarum, while Doyle (1925) and Pappenhein, Dunn and Conn (1926) recognised the disease in America as neuritis, in chickens, and neuro-lymphomatosis respectively. In Germany, the disease was described by Dobberstein and Hauft (1927) under the name of polyneuritis.

The term " fowl paralysis " is a confusing one, and embraces many conditions, and is generally used to describe any condition where there is paralysis of the legs or wings. Paralysis of the limbs in fowls may be due to various infections, of which the most common are intestinal worms, coccidiosis, spirochætosis, and avitaminosis, but these are by no means the only causative agents. It is unnecessary to discuss here the above conditions, for the infections which have recently come under my observation were not attributed to any one of the above factors. Unfortunately there has only been an opportunity on two occasions to investigate the disease, and it was not possible to carry out all the experiments which were desired.

Fowl No. 1.—A pen of pure-bred birds was imported from England in August, 1929, and three months later one of the birds was noticed to be unable to move its legs, although there was complete use of both wings. The bird was sent to the laboratory, and was kept under observation for a period of two months. The bird to all appearances was perfectly healthy, excepting that it was unable to move its legs. It fed well, but gradually became emaciated, and its general condition grew worse, and it lost weight steadily, so much so that before it was destroyed it was a mere skeleton. The bird never exhibited any lethargic symptoms, but was always bright. When placed in a standing position it immediately collapsed and fell to the ground on its side, and by the help of its wings brought itself on to its breast and remained in that position. Throughout the period of two months there was never any loss of power of its wings. The temperature of the bird was taken at the time of arrival, and at intervals throughout the illness ; it varied between 106.7° F. and 108.4° F., which is within the normal range of temperature of a bird in this country.

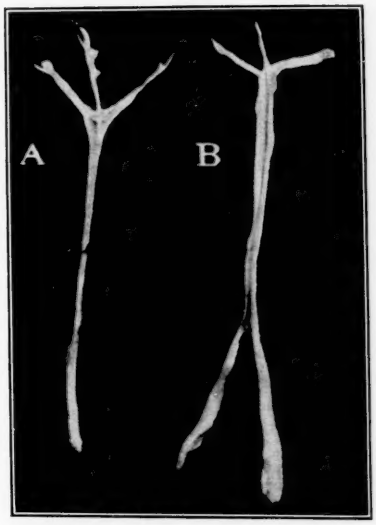
Microscopic examination.—Frequent blood examinations were made, but all proved negative, while fæcal examinations revealed the presence of a mild infection of internal parasites.

Blood inoculations.—On two occasions blood from the infected bird was inoculated into healthy birds, but with negative results.

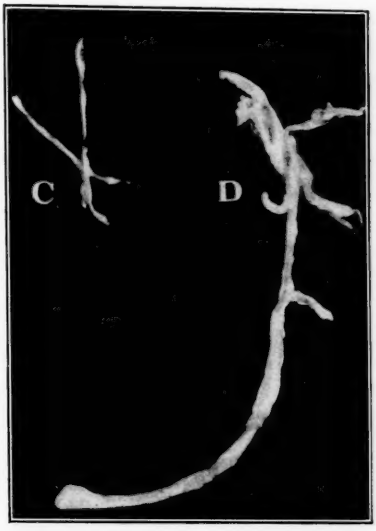
Contact experiment.—Healthy birds kept in contact for a period of eighteen days with the sick bird did not reveal any symptoms of illness. A variation of diet with a view to the introduction of fresh vitamins did not appear at any time to improve the bird's condition.

Post-mortem.—An examination of the stomach and intestines revealed nothing unusual. Intestinal parasites, both flat and round worms, were present, but not to any excessive degree. Nothing of a pathological nature was observed in any of the organs contained in either the thoracic or abdominal cavities. The muscles of both legs were remarkably pale in colour and emaciated. A careful

XUM



A—Normal sciatic plexus and nerve.
B—Diseased sciatic plexus and nerve.



C—Normal brachial plexus and nerve.
D—Diseased brachial plexus and nerve.

(See page 339)

STATE COLLEGE OF AGRICULTURE AND APPLIED SCIENCE
LIBRARY
SEP 14 1932
MANHATTAN
KANSAS

XUM

dissection of the lumbar sacral plexus revealed a marked thickening of the nerves of the plexus, especially of the nerves of the left side, though the plexus of the right side was also enlarged and considerably thicker than the plexus in a normal bird. The spinal cord, on macroscopic examination, appeared normal.

Fowl No. 2.—A native bird, one amongst a flock brought for sale, was noticed to be unable to move, exhibiting symptoms characteristic of fowl paralysis, and with only partial control of its wings. The bird was isolated, and a variety of food, millet seed, lettuce, cooked maize, raw and cooked liver was given, but little improvement was noticed at the end of a month.

The weight of the bird after a month's feeding was 495 grammes, and the bird was able to move its limbs with limited movement. On the suggestion of McCulloch, cod-liver oil was then administered daily in addition to the diet previously mentioned. Six days later the bird had considerably improved in condition, and was able to walk, but the limbs were still rigid, and the movements inco-ordinate. The weight was now 810 grammes, a considerable increase considering the short period it had been on a special diet. Twenty-eight days later the weight of the bird was 900 grammes, and it had commenced to lay. It was able to run about, but inco-ordinate movements of the limbs still existed. As no further improvement was noticed, it was decided to destroy the bird. On post-mortem examination all organs appeared normal. A few nematodes were present in the intestine. The muscles of the limbs were pale in colour and partially atrophied. A dissection of the lumbar sacral plexus and brachial plexus showed well-marked bilateral thickening. The lumbar sacral plexus was 3 mm. in diameter, and the narrowest part of the sciatic nerve was 2.5 mm. thick, while the broadest part was 3.8 mm. The brachial plexus was 4.6 mm. in thickness, and the nerve an inch from the plexus was 3 mm. in diameter. A healthy bird, approximately the same size as the diseased bird, was killed, and both the brachial and the sciatic plexus exposed. The brachial plexus in this case was only 2 mm. in thickness, and an inch from the plexus the nerve was 1.25 mm. thick, while the sciatic nerve was 2 mm. thick. The accompanying photographs illustrate the differences in size between the nerves of the diseased and those of the healthy fowl.

Microscopic examination.—Fæcal examination only revealed the presence of a few helminth ova in smears, which were frequently examined during the time the bird was under observation. A histological examination of the sciatic nerve showed a marked infiltration of small round cells and some degeneration of the fibres. This cellular infiltration was so great in parts that the cells were densely packed together.

Discussion.—The above symptoms, together with post-mortem and histological findings, agree with the observations of investigators previously mentioned who have had the opportunity of studying many cases of this infection ; many varieties of symptoms which are associated with the disease, such as iritis and blindness, were not observed, nor were other advanced signs, such as wry-neck and inco-ordination of the muscles involving both legs and wings. Neither of the two

XUM

cases which came under my observation was in the most advanced stage of the disease, and in the case of Fowl No. 2 there was undoubtedly a tendency towards recovery. The cause of this infection is still unknown, though fruitless attempts have been made by investigators to isolate an organism. Although it has been claimed by some to be transmissible by inoculation, and that the cause of the disease is a filtrable virus, much evidence is still required before a definite conclusion can be drawn supporting this view. The question of avitaminosis has been excluded as a factor, for in many outbreaks where the disease has claimed a high mortality the question of food has been investigated, and the birds were receiving a diet where the vitamin proportion was all that could be desired. In the case of the infection quoted by McCulloch, the cause was no doubt due to the lack of certain vitamins in the daily food, for a rapid recovery resulted as soon as these vitamins were added, and no doubt the condition was one due to avitaminosis, and not the disease " polyneuritis gallinarum."

The economic importance of the disease polyneuritis gallinarum cannot be over-estimated, for not only does it account for a high mortality, but it frequently takes the form of an epidemic, and further, according to Doyle, and more recently observed by McGaughey and Downie, birds which have been hatched from eggs from an infected flock develop the disease. The interesting features in connection with the two cases which came under observation were, in the first case, the bird was imported from England, but did not show any signs of sickness for a period of three months after arrival in Nigeria, and none of the other birds in the flock contracted the disease ; while the second case was a native bird, which indicates that the disease exists in Nigeria and that the imported fowl contracted the disease after its arrival in this country.

REFERENCES.

McGaughey, C. A., and Downie, A. W. D. : *Journ. Comp. Path. and Therap.*, XLII, I, 63.
Thomas, A. D., 1928 : *Journ. South Afric. Vet. Med. Assoc.*, I, 67.
McCulloch, W. E. : *West Afric. Med. Journ.*, Vol. 2, p. 105.
McCulloch, W. E. : *West Afric. Med. Journ.*, Vol. 3, p. 69.

THE BRITISH MEDICAL ASSOCIATION.

The First Hundred Years. Notes on the Association's History.*

The British Medical Association, which was founded at Worcester on July 19th, 1832, by Sir Charles Hastings, celebrates its centenary at the close of this month, under the Presidency of Lord Dawson of Penn. We print below the eighth of a series of advance extracts from the " History of the Association," compiled by Mr. E. Muirhead Little, F.R.C.S., at the invitation of the Council, for publication in book form at the time of the commemorative proceedings in Worcester and London. The

* Reprinted by permission of the Editor of *The British Medical Journal.*

XUM

concluding article of the series, on the Association's Journal, will appear in "The British Medical Journal" special Centenary Number, to be published on July 23rd.

The Association and Quackery.

In the early days the Provincial Medical and Surgical Association advocated the prohibition of all medical and surgical practice except by legally qualified persons, but it very soon became evident that this was an object impossible of attainment. Since 1840 the numerous Bills proposed or supported by the Association have not contained clauses designed to forbid unqualified practice. It is, however, worthy of remark that of late years, without much notice or resistance, the legislature has passed measures absolutely forbidding the practice of midwifery, of dentistry, or the treatment of venereal diseases by unqualified persons, and no one may now call himself or herself a veterinary surgeon without legal qualification. All other departments of medicine and surgery are freely open to every man, woman, or child in Great Britain, provided that the unqualified practitioner does not attempt to prescribe or administer drugs included in the operation of the Dangerous Drugs Acts or infringe the provisions of the Medical Act by representing himself to be a registered medical practitioner. As may well be imagined, the ingenuity of the unqualified practitioner is frequently and successfully exercised with the view of infringing the spirit of the latter restriction while keeping inside the letter of the law.

The discussion which took place at the annual representative meeting in 1930, on the report of the action of the Association's representative (Dr. Alfred Cox) at the previous conference of the Association Professionnelle Internationale des Médecins, showed that there is no change in the public attitude on this matter, and no likelihood of any legislation on it in this country. Moreover, it was stated at the conference that in those countries where unqualified practice was forbidden by law it nevertheless flourished, and quackery was quite as rife as in countries which, like Great Britain, made little or no attempt to restrain it. The subject must be considered as outside practical politics. Dr. Cox said that personally he did not believe it was possible to suppress the desire of human nature for quackery. Almost unanimously the representative meeting approved the opinion expressed by Dr. Cox at the Paris meeting as to the impracticability of any attempt to put down unqualified practice by means of legislation.

Before the passing of the Medical Act a Committee on Quackery was appointed which in 1851 presented a report condemning the practice of homœopathy. In more recent years a wider view has been taken, and it has been realised that in medicine there is no orthodox doctrine, but that when once a man has obtained a registrable qualification in the usual way he is entitled to hold his own opinions on therapeutics.

Secret Remedies.

But the sale of remedies of secret composition and their apparent legitimisation by the imposition of a Government tax and stamp has been denounced by the

XUM

Association from its very early days. In 1839, a Committee of the Provincial Medical and Surgical Association on Quackery pointed out that the revenue derived by the Government from this source amounted to £50,000 per annum. It recommended the delivery of lectures on empiricism, and the circulation of tracts. In 1841, the Committee on Empiricism recommended the abolition of patents for secret remedies, and of the tax upon them. In 1840, the report had run: "Your Committee would suggest the propriety of appropriating a part of the funds of the Association in obtaining trustworthy analyses of many of the more popular and injurious quack medicines."

Sixty-nine years later this suggestion and subsequent ones were acted upon, when a series of articles on the composition and cost of secret remedies appeared in the *Journal*, and these articles were republished in book form in 1909, under the title "Secret Remedies, what they Contain, and what they Cost." This volume had a very considerable sale, and no doubt had a good effect in opening the eyes of the more sensible of the lay public, so that they realised how slight were the grounds upon which the proprietors of so-called patent medicines based their claims to therapeutic success. That volume was followed by another, "More Secret Remedies," which was published in 1912. The Association has more than once urged upon the Government of the day the desirability, in the interests and for the protection of the public, of making the publication of the composition of every secret remedy compulsory by an enactment that the names of the ingredients and their quantities should be printed on the labels of all co-called "patent" medicines. The analyses made for the Association in the investigations which led up to "Secret Remedies" showed how widely the composition of the same nostrum often varied at different times. In the frequent cases where their components were practically inert, this did not much matter, but in the case of others containing active drugs such as opium and acetanilide, it constituted a grave danger to the public. This glaring defect was, however, used by some proprietors of the remedies as an argument to discredit the analyses published by the Association, for they were able to show that these analyses in some cases differed from those made of specimens of preparations purchased at another time, or perhaps in another place. "Secret Remedies" and its sequel, however, showed conclusively with how little care and regard to accuracy many preparations had been made up. In the case of pills and powders, variations in strength could be and were clearly demonstrated.

Only one action was brought against the Association on account of these publications, with the result of a verdict for the defendants. Nevertheless, the trade still goes on and flourishes, and no administration seems likely to forgo the income derived from that source, although it may be hoped that publication of the formula of composition on the label may some day be insisted upon as a condition before the Government stamp is affixed. In that case, secret remedies would cease to be secret, and would lose most of the power to impose on the credulous.

XUM

Select Committee on Patent Medicines.

In 1912, the Government appointed a Select Committee to consider and inquire into the question of the sale of patent and proprietary medicines and medical preparations and appliances and advertisements relating thereto, to which the Association forwarded a memorandum of evidence. In support of this evidence the following witnesses appeared before the committee: Sir Malcolm Morris, Professor W. E. Dixon, F.R.S., Mr. P. MacLeod Yearsley, Dr. Arthur Whitfield, Miss Mary Sturge, Dr. R. E. Crosse, Mr. Henry Sewill, Mr. E. F. Harrison, F.I.C. (responsible for the analyses in " Secret Remedies " and " More Secret Remedies ") and the medical secretary.

The Select Committee reported in August, 1914, and made certain recommendations, which the Council considered to be " of the most far-reaching and satisfactory kind." They included the registration of all proprietary remedies on the basis of confidential communication to a competent authority of the formula of every remedy, a full statement of the therapeutic claims made or to be made, and in the case of appliances, the deposit of a specimen: the administration of the law governing the sale and advertisement of proprietary remedies, including the new machinery, to be a function of the Ministry of Public Health, " when such a body is created," and in the meantime of the Local Government Board. Other recommendations of the Committee included the amendment of the Indecent Advertisements Act on the lines suggested by the Association, and the total prohibition of the advertisement and sale (except the sale by doctor's order) of medicines purporting to cure the following diseases: cancer, consumption, lupus, deafness, diabetes, paralysis, fits, epilepsy, locomotor ataxy, Bright's disease, and rupture (without operation or appliance). The prohibition of all advertisements of remedies for sexual diseases, and of medicines which suggest that they might be used as abortifacients, was also recommended, as well as measures for frustrating many well-known knavish tricks of the nostrum-mongers. The Select Committee expressed its strong desire that there should be early and effectual legislative measures taken to bring into operation the foregoing recommentations. High hopes were then entertained that a Bill would soon be introduced and passed into law, giving effect to the recommendations, but the continuation of hostilities, and the events which followed the armistice, and even the official end of the war in 1921, prevented the fulfilment of the hopes of the committee and of the Association. The Government introduced and passed through the House of Lords in 1920 a Bill to regulate the manufacture and sale of certain medicines and surgical appliances, but it never got any further, owing, it is understood, to the difficulty of reconciling the various vested interests concerned. It can, however, be safely said that the action of the Association, coupled with the new sense of responsibility which is actuating many educated advertising agents, has led to a considerable improvement as regards the grosser forms of quack advertisement.

XUM

URINARY CALCULI IN SHEEP.*

By B. E. PONTIUS,
Associate Professor of Animal Husbandry;
R. H. CARR,
Professor of Agricultural Chemistry; and
L. P. DOYLE,
Associate in Veterinary Science, Purdue University Agricultural Experiment Station.

Introduction.

The occurrence of calculi in sheep may not be more frequent than in other animals, but present knowledge of the subject indicates that it probably is. Possibly this trouble occurs much more often than is generally supposed, for if the calculi are small and few in number, they may not noticeably affect the animal, and therefore may escape detection. Furthermore, it is highly probable that a good many cases are missed because the average sheepman and some veterinarians do not recognise the symptoms.

Frequent references in early livestock literature to "gravel" and "stones," the terms most commonly used by sheepmen to designate calculi, indicate that they have long been known and recognised by experienced sheepmen. The cause of their formation has been attributed to (1) roots, particularly mangels; (2) hard water; (3) high condition; (4) lack of exercise; and (5) chilling from east winds in the early spring after shearing. When sheep are affected with calculi, the voiding of urine is restricted, and in some cases is entirely prevented. Concerning this symptom, Youatt[14] (pp. 588–589) says:

"It is mostly seen in males, and particularly rams, while being got up for exhibition purposes, under the influence of rich, highly stimulating food. The chief cause of this defect as seen in sheep is due the presence of minute sandy particles which block up the urinary passage at the extreme end of the penis (worm). This gravelly matter is deposited from the urine while in the bladder, and when passing along the canal becomes arrested in the small worm-like appendix of the organ, thus shutting in the urine and preventing its escape. The deposition of sandy matter in the bladder is said by practical flockmasters to arise from the excessive use of mangels and other foods rich in sugar. We think, however, that the want of exercise, and the habit of going for long periods without emptying the bladder, as do fat lazy sheep, has much to do with it."

A survey of the literature indicates that the calculi are usually produced by formations of calcium carbonate, calcium and aluminum phosphates, aluminum silicate, together with kidney tissue urates, epithelium, etc. Michael[10] studied calculi of sheep for five years. He obtained data from lots of rams fed (1) grain and clover hay; (2) grain, hay, and corn silage; (3) grain, hay, and mangels; and (4) grain, hay, and sugar-beets. In lots 1 and 2 no calculi were found, and the urinary organs were normal, but in lots 3 and 4 there were a number of cases of calculi, and all but four of the rams in lot 4 had distended bladders. Six of the

* Reprinted from *Journal of Agricultural Research*, Vol. 42, No. 7. Washington, D.C.

XUM

11 in lot 4 had enlarged gall-bladders, four had enlarged hearts, six had enlarged kidneys, and most of them showed irritation in one or more parts of the urinary tract. Michael attributes the enlargement of the organs to the large amount of water ingested, which caused distention and increased the activity of the kidneys. These results would appear to indicate that the mangels and sugar-beets were responsible for the formation of calculi.

Hager and Magath[4, 5, 6] produced vesical calculi experimentally in rabbits and guinea-pigs. They catheterised the bladder and then introduced 0.5. c.c. of a 0.1 per cent. alcoholic solution of salicylic acid, which produced a marked excoriation of the mucosa. After this injection, 1 c.c. of a twenty-four hour broth culture of *Proteus ammonieæ* was introduced into the bladder through a catheter. This resulted in the production of a severe grade of incrusted cystitis which lasted for an indefinite period, the urine becoming markedly alkaline. These investigators recognised bacteria from two sources which they believe are concerned in "stone" formation; (1) endogenous, which originate in foci in the body, and (2) exogenous, which gain entrance to the urinary tract by direct implantation. Post-mortem examinations revealed both free stones and incrustations. Their conclusions[6] (p. 269) in part are that: "*Proteus ammonieæ*, being able to convert urea rapidly into ammonia, precipitated the alkaline earthy salts in the urine, forming chiefly the carbonates and phosphates of calcium and magnesium; these precipitates became attached to the abraided mucous surface. It was noted at the time of the experiments that there was a tendency for these precipitates to break off and form free calculi in the bladder. . . ."

Several different investigators have obtained results which indicate that certain dietary deficiencies may be a predisposing cause of calculi. Osborne and Mendel[11] found calcium phosphate calculi prevalent in rats which had been kept on a diet deficient in vitamin A. A study of the diet of these rats showed that "in every instance where calculi developed the animals were without an adequate source of the fat-soluble vitamin for some time." Fujimaki[3] found that rats fed on a diet deficient in vatamin A developed bladder calculi, but when vitamin A was again included in the diet the bladder stones disappeared. Animals fed on a diet deficient in vitamin A, inorganic phosphorus, and calcium, formed calculi in a very short time. Bile duct stones took longest to form, and the urinary calculi formed were carbonates. Calculi in animals fed on diets deficient in vitamin A, or vitamins A and C, were phosphatic. McCarrison[8] obtained vesical calculi in rats fed on diets characterised by the absence of protein of animal origin, a deficiency of vitamin A, and an excess of earthy phosphates. Stones were found in 29 per cent. of the 72 animals used in the experiment, but the stones did not appear until the unbalanced diet had been fed for fifty-six days. Keyser[7] found that feeding oxamide produced artificial concretions consistently. Oxamide is a foreign crystalloid in the urinary tract. It is precipitated with colloidal material of urine in such a way that fusion of crystals occurs. Concretions are apparently of endogenous origin, and are due to defects in metabolism which cause changes in the hydrogen-ion concentration or colloidal content of the urine.

XUM

The occurrence of xanthine calculi in sheep has been reported by Easterfield, Rigg, Askew, and Bruce.[1] This type is widespread among sheep on poor soils in New Zealand, especially on soils that are deficient in limestone and phosphoric compounds. The greatest incidence of calculus occurred where great deterioration in pasture had taken place. The pasture grass is very high in nitrogen compounds, the nitrogen ranging from 3.43 to 5.23 per cent. Sheep grown on this pasture are badly stunted, and some of the excess nitrogen in the bladder is deposited in the form of xanthine ($C_5H_4N_4O_2$). Where the poor soils were limed and treated with a phosphate fertilizer and good pastures established, no calculi in the kidneys of sheep were recorded. Another cause of calculi formation was reported by Tennant.[13] He found instances in which the sulphur contained in food was not oxidised and eliminated as sulphates, but as cystine. This amino acid, being very insoluble in urine, formed human kidney stone concretions.

The results of Evvard, Culbertson, and Wallace[2] (p. 585) indicate that molasses in the diet has some effect on the formation of urinary calculi in feeding lambs. Lots fed on beet molasses showed a larger percentage of cases than lots fed on cane molasses. Thirty per cent. and 48 per cent. respectively of the lambs in lots fed daily on 0.5 pound and 0.7 pound of molasses per lamb had calculi. Evvard *et al.* believe that " these calculi findings are of practical significance inasmuch as they show quite unmistakably that the feed is a factor in their formation."

Frequency of Occurrence of Calculi in Sheep.

An attempt was made to obtain data on the prevalence of urinary calculi in sheep. For this purpose a questionnaire was sent to fifty-three prominent sheepmen in different parts of the United States and south-eastern Canada. Forty-five replied. Of these, only eight had had no calculi trouble in their flocks, and did not know of its occurrence. The eight replies came from New Hampshire, New York, Vermont, Massachusetts, Ohio, Virginia, West Virginia, and Texas. However, other replies from four of these States reported cases of calculi. In all, 230 cases, covering a period of from two to fifteen years, were reported by forty different men. Twice as many cases of calculi were reported where roots were not fed as where they were. Several instances were mentioned in which rams were fed on a ration composed chiefly of roots for several months without any trouble from calculi. Apparently drinking soft water does not always prevent the formation of calculi, as several cases were reported in sheep that had had only soft water to drink. The occurrence of the trouble was said to be most frequent during the winter months, when the ration contained a considerable amount of grain, or when the sheep were being fed heavily on grain for exhibition purposes. However, cases were reported which occurred during the summer, when the sheep were on pasture and were being fed grain, and in a few instances when they were on pasture and received no grain. The rations fed to the sheep affected were composed, in most cases, of the following feeds: Corn, barley, oats, bran, linseed meal, legume hay, and corn silage.

XUM

Some sheepmen believe that this trouble is restricted largely to limestone sections. The present writers are convinced that this trouble is not restricted to such regions, for they have records of cases which have occurred in regions in which the soil is quite acid. As far as one may judge from these reports, it appears that the occurrence of calculi is rare in the New England States, New York, Maryland, Pennsylvania, Virginia and West Virginia, and that it is relatively common in Indiana, Wisconsin, Iowa, Kansas, Missouri, Oregon, Utah, Colorado and California.

Observed Cases of Calculi.

During the past five years, twelve well-defined cases of calculi have been observed in the Purdue pure-bred flock, and detailed records of these have been kept. Fifteen western feeding lambs which were brought to the veterinary clinic of the station for post-mortem diagnosis had calculi. They came from four different farms. During the winter of 1929–30, fifteen cases were observed among the 224 western feeding lambs being fed experimentally at the Purdue experiment station. Five lambs died from calculi during the feeding period, and the remaining 219 were posted when slaughtered. Ten had calculi, and in 67 others evidence was found of irritation in the urinary tract, which strongly suggested either that calculi had been present and had passed out with the urine, or that the conditions which prevailed in the urinary tract were conducive to the formation of calculi. However, this was the first time that any appreciable amount of this trouble had been observed in feeding lambs at this station during seventeen years of sheep-feeding trials. The anatomical features of the urinary tract in the male sheep favour the lodgment of calculi or other obstructive bodies in the urethral portion of the tract. There are three places in the penial urethra at which calculi are particularly likely to lodge, namely, the ischial curve, the sigmoid curvature, and the processus urethræ or "worm." The changes in direction and the accompanying narrowing of the lumen of the urethra at the curvatures make it difficult for calculi to pass these points. The small lumen of the processus urethræ is likely to cause the retention of calculi of any appreciable size.

Only a few typical cases observed by the writers will be described. The details vary considerably in individual cases, but the major features are common to all. The writers have found calculi in every part of the urinary tract, but in only one case were calculi found in every part of the urinary tract in the same sheep.

"*Case No.* 1 (Purdue, 1664).—A Rambouillet yearling ram had an attack of calculi in May, 1928, which was a "dry" case. He was operated on, but without success, and was immediately killed and posted. Calculi were found in both kidneys as well as in the bladder, and the ureters and urethra were nearly filled with small concretions throughout their entire length. Stoppage was complete in both the ischiatic and sigmoid curvatures. The bladder and kidneys were greatly distended with urine, the kidneys being three times their normal size. There was necrosis in the bladder wall extending over an area about 4 cm. in diameter. Rupture of the bladder at this point would evidently have occurred

XUM

within a few hours. The ram had been fed a mixture of corn and oats, alfalfa hay, and silage during the winter, but had been on pasture for ten days previous to the attack. He was a rugged, healthy sheep, and was not in high condition when stricken.

"*Case No.* 2 (Purdue, 1498).—A three-year-old Rambouillet ram had an attack on February 24th, 1928. When he was first observed, stoppage was only partial, but two days later became complete. An examination of his "worm" was made, and a calculus was found in it. The worm was severed, and voiding of urine began immediately. In a few days, recovery was complete.

"*Case No.* 3 (Purdue, 1698).—A two-year-old Shropshire wether had his first observed attack October 17th, 1929. It was not severe, and in three days he appeared to have recovered. On October 23rd, 1929, he had a second attack, which was more severe than the first. The voiding of urine was reduced to a slow seepage. His worm was examined, and found to be normal. A probe was inserted into the urethra as far as the first part of the S curvature, but without result. It was decided that the obstruction was so located that there was no hope of removing it. Consequently the animal was killed and posted. Only one calculus was found in the entire urinary tract. It had lodged in the proximal portion of the sigmoid curvature. During the summer, and until stricken, the wether had run with the ewe flock on pasture; and for several weeks previous to the attack he had been fed one-half pound daily of corn and oats, equal parts.

"*Case No.* 4 (U. S. D. A. 59 C).—A three-year-old Southdown ram had his first attack January 1st, 1927. Examination revealed small calculi in the worm, but removal of the worm gave only temporary relief. Further examination showed that calculi had lodged in the urethra below the sigmoid curvature. They were located by forcing the penis out of the sheath and pressing the penis between the thumb and first finger. The calculi were forced out of the penis. Voiding of urine began, and the ram improved steadily for three days. On the fourth day, however, he showed marked symptoms of pain, and twenty-fours later died. A post-mortem examination showed a gangrenous condition of the penis, which was evidently caused by forcing the concretions out of the urethra. No calculi were found in the other parts of the urinary tract.

"*Case No.* 5 (Purdue, 1750).—A Hampshire yearling wether showed the first symptoms of calculi, July 5th, 1929. A large calculus was found about one inch above the proximal end of the worm. The worm was inflamed, but had not adhered to the penis. It was severed, and the calculus was removed. The wether's condition improved, but three days later a second attack occurred in which urination was inhibited. Several doses of formin tablets were administered, and the animal recovered. It is by no means certain, of course, that the formin was responsible for his recovery. He had been fed on a grain ration of three parts oats, one part corn, since January 1st, and had been on rape and bluegrass pasture for three weeks previous to the attack."

XUM

Autopsy Report.

When the voiding of urine is largely or wholly inhibited for a period of about forty-eight hours, the bladder or some other portion of the urinary tract usually ruptures. About twenty-four hours later death occurs. The conditions found in an autopsy of a ram which had calculi, causing the bladder to rupture, are presented below. The abdominal cavity contained a large amount of bloody urine. There was also a slight amount of fibrinous peritonitis. The scrotum contained bloody fluid and some clots of fibrin. The fat in the region of the kidneys and the renal lymph glands was infiltrated with fluid. The gall-bladder was distended with bile. No other lesions were found outside the genito-urinary organs. The ureters were distended with bloody urine, and showed the effects of many hæmorrhages, particularly near the kidneys. The kidneys were somewhat enlarged, due mainly to distention of the pelves and calyces by urine. Large hæmorrhages had occurred under the lining of the pelves ; and the kidney cortex and medulla contained many petechiæ. There was some gross evidence of parenchymatous degeneration in the kidneys. The capsules of the kidneys stripped easily. No calculi were found in the ureters or kidneys. The urinary bladder was perforated in the dorsal wall, and showed many subserous and submucous hæmorrhages. There were many whitish, rather soft calculi, and some blood clots in the bladder. Some of the calculi were 1 cm. in diameter. The penial urethra was packed with calculi from a point at the beginning of the ischial curvature to a point about an inch beyond the beginning of the S curve. The urethra was free from obstruction throughout the rest of its course, but was hæmorrhagic throughout its entire length.

Size and Composition of Calculi.

The cases studied were of two kinds—those in which one or more large stones were present, and those in which large numbers of small stones were present. The stones varied in size, shape, crystalline structure, hardness, and chemical composition. The large ones had relatively larger deposits of mineral salts, and were usually harder than the smaller ones. The small ones looked much like fine grains of sand. They contained relatively more organic matter than the large ones, were porous, and generally soft enough to crumble when pressed between the fingers. The concretions were composed of calcium phosphate or aluminum silicate, largely the former, depending on whether grain or hay was most abundant in the ration.

Symptoms of Calculi.

Partial or complete stoppage of the urinary tract is the most positive evidence of calculi. Affected sheep refuse their feed, or eat very little of it, the head is often carried low, the back becomes arched, especially when the animal strains in trying to urinate, and there is a tendency not to exercise. The animals become dull and listless, and in advanced stages are very sick. They are inclined to lie down most of the time, usually on their bellies. When they get up, they frequently stamp their hind feet. The wool around the end of the sheath is almost

XUM

invariably wet. If there is any suspicion that a sheep may have stones, the wool immediately around the end of the sheath should be examined. This symptom is frequently the only reliable one in the early stages.

A specimen was obtained from a Rambouillet ram, Purdue, 1498. Stoppage was complete. The stones in the worm can be felt with the fingers, and may be removed in some cases by pressure, but it is generally better to sever the worm near its proximal end. In some cases the worm becomes attached to the penis. This condition was found in the majority of the cases observed, and evidently favoured the lodgment of calculi in the "worm."

Recurrence of Attacks.

The first attack may or may not prove fatal. If the symptoms are recognised soon enough, and if the stoppage is in the worm, the calculi can be removed and recovery follows, provided there is no stoppage in other parts of the urinary tract. In the cases studied by the writers, those that survived the first attack—and a large percentage did—had a second attack, which was always more severe than the first. The number of recoveries was small, partly for the reason that in the Purdue flock a second attack generally meant that the calculi had lodged above the curvature, since the worm was usually removed at the time of the first attack. A few sheep have survived the second attack, but a third attack has proved fatal in every case. One attack is generally followed by a second attack, and in a few cases by a third. Wether lambs are not kept after they have recovered from the second attack.

Preliminary Observations and Experiments.

A survey of the literature showed that published data on the composition and hydrogen-ion concentration of sheep urine are very meagre. It was evident, therefore, that it would be necessary to obtain samples of urine from a number of different sheep kept on known rations in order to determine what should constitute normal urine from animals on these rations. This was done, and it was found that the pH values of urine from different individuals ranged from 6.8 to 9.0, depending on the kind of ration fed, and possibly to some extent on the individuality of the sheep. This finding suggested that a study of the urine might reveal to what extent the ration is utilised in metabolism.

Feeding Experiments.

Feeding experiments designed to show how a certain feed affects the reaction or composition of the urine were formulated. For these tests sheep one year old, and older, were selected from the Purdue flocks. Ewes, wethers, and a few rams were used. A crate, 4 by 6 ft., having $\frac{1}{2}$ in. mesh-wire bottom and a drain pan, was constructed. The mesh-wire bottom was covered with burlap, which permitted the collection of both fæces and urine. The sheep were fed in dry lots, and were prepared for the experiment by being fed the ration to be tested for two weeks prior to the beginning of the experiment.

XUM

First Series.

In the first series of experiments three different rations were selected for comparison. Three sheep were placed in each of three different lots. Lot 1 was fed alfalfa hay only; lot 2, corn silage and grain, two parts oats, and one part corn; lot 3, mangels and corn stover. The rations were fed for six weeks, and composite samples of urine and fæces were taken during this interval. Two sheep were placed in the crate for each run, and the runs were for twenty-four hour periods. The average daily feed and water consumption per sheep, the amount of urine voided, its pH concentration, its percentage of total solids and ash, and the amount of 0.20 N hydrochloric acid required to neutralise 100 c.c. of urine ash, are given in Table I.

TABLE I.—INFLUENCE OF THE FIRST THREE RATIONS TESTED UPON THE QUANTITY AND COMPOSITION OF THE URINE VOIDED; AVERAGE PER SHEEP PER DAY.

Lot No.	Daily feed	Average daily water consumption	Average urine voided daily	pH of urine	Total solids of urine per cent.	Ash in urine per cent.	Quantity 0.20 N HCl required to neutralise 100 c.c. urine ash
		Pounds	c.c.				c.c.
1	2.87 pounds alfalfa hay	2.79	312	9.0	8.5	5.5	90.6
2	2.6 pounds grain; 1.75 pounds corn silage	1.44	207	7.16	6.7	1.75	.2
3	11 pounds mangels; 0.6 pound corn stover	—	2,310	8.62	1.63	0.91	33.2

The data in Table I show significant differences in the quantity of urine from the three lots. The large amount voided by the sheep in lot 3 is of particular interest. Twenty-three hundred and ten cubic centimetres per sheep during twenty-four hours is a very large output. It should be noted that the sheep in this lot drank no water. The differences in the pH values, the percentage of ash, and the amount of 0.20 N HCl required to neutralise the water-soluble bases in the ash, are of especial interest in connection with the problem under consideration. The urine from the sheep in lot 1 was very alkaline when voided, having a pH value of 9.0 to 9.2. It contained 8.5 per cent. of total solids, 5.5 per cent. of ash, and required 90.6 c.c. of 0.20 N HCl to neutralise the water-soluble bases in the ash of 100 c.c. of urine. These data indicate that an abnormally large quantity of nutrient material was being eliminated by way of the kidneys, and the large ash content might suggest a tendency to form calculi, but it was mostly water-soluble, and there was no evidence of the formation of any gravel by combination with the potassium or other elements present.

The sheep in lot 2 produced what appeared to be more normal urine, having a pH value of 6.9 to 7.3 with a volume of 225 c.c. per sheep in twenty-four hours. The total solids averaged 6.7 per cent., and the ash 1.75 per cent. That the ash material contained only traces of soluble bases is shown by the fact that only 0.2 c.c. of 0.20 N HCl was required to neutralise 100 c.c. of urine ash.

XUM

This would indicate that the soluble bases in the feed were neutralised by acid radicals—phosphates, silicates, and sulphates—contained or produced by the feed.

The fresh urine from lot 3 had a pH range of 8.4 to 8.8. It contained only 1.63 per cent. of total solids and 0.91 per cent. ash. The relatively large amount of 0.20 N HCl required to neutralise the alkalinity of the ash of this very dilute urine appears to the writers to be very significant. It was due largely to the presence of compounds of potassium in relatively large amounts. Since this element does not form many compounds which are insoluble in water, it is not probable that the cause of calculi formation is the presence of beets in the ration, but rather that the beets, so far as they are concerned, may serve to prevent the formation of calculi through the production of water-soluble in place of water-insoluble compounds.

Many cases of calculi have been reported in sheep which were being fed on roots, particularly mangels, but the rations fed in these cases almost invariably contained, in addition to the roots, legume hay and grain. Roots may be a contributing factor when fed along with hay and grain, for the calcium in the roots may combine with the phosphorus in the grains to form calcium phosphate, which is the chief component of most of the calculi analysed by the writers. This is an admission that roots may be a contributing factor under certain conditions, but not that roots are a primary cause of calculi formation. The fact that calculi are formed when the ration does not contain roots, and when sheep have never been fed on roots, leads the writers to believe that their occurrence is not wholly dependent, if at all, on the presence of roots in the ration.

The replies to our questionnaire mentioned showed that its occurrence was more frequent when the ration did not contain roots. The present studies lead us to believe that calculi formation is impossible when roots only are fed, and that they are not likely to be formed when the ration is composed of roots and legume hay, or roots and grain.

The three lots of feeds used in these experiments represented widely different mineral balances. The potassium compounds predominate in the basic material in beets, making the urine ash alkaline, as there are no acid-producing compounds present in quantity with which to combine. The alfalfa hay ration is outstanding in its calcium content, but low in phosphorus and sulphur. Hence the urine ash is very alkaline. The grain and silage ration is low in basic materials, and high in silicates and phosphates. Hence the urine ash is usually neutral or even slightly acid.

Second Series.

In a second series of experiments the study was extended to include a number of different combinations of feeds. These are shown in Table II.

Rape *v.* Bluegrass Pasture.

Since rape pasture is often provided for sheep, this feed was used for study in contrast with bluegrass pasture, which is usually rated well whenever it can be

XUM

obtained. It was found that the sheep fed rape produced somewhat more basic urine than those fed bluegrass. Urine from the former contained 5.44 per cent. total solids, and 16.5 c.c. of 0.20 N HCl were required to neutralise the ash; whereas the urine from sheep fed bluegrass contained 3.3 per cent. total solids, and 10.0 c.c. of HCl were required to neutralise the ash.

TABLE II.—INFLUENCE OF VARIOUS RATIONS FED UPON THE QUANTITY AND COMPOSITION OF URINE VOIDED BY SHEEP.

Ration	Average amount of urine voided	Total solids in urine	Quantity 0.20 N HCl required to neutralise 100 c.c. urine ash	Ash in urine	pH of urine	Crystals formed in standing urine
	c.c.	per cent.	c.c.	per cent.		
Rape pasture	*529	5.44	16.5	3.71	7.5–8.5	None
Bluegrass pasture	*520	3.3	10.0	2.90	7.6	do.
Alfalfa hay, 2 pounds; oats, 1.5 pounds...	*183	3.91	22.3	1.10	7.8–8.6	Few
Alfalfa hay, 2 pounds; corn, 1 pound ...	†275	4.38	17.8	1.48	7.8–8.2	do.
Bluegrass pasture; mixture of 3 parts oats and 1 part corn, 1.5 pounds	*330	3.91	11.0	1.52	7.5–7.7	None
Bluegrass; mixture of 2 parts corn, 2 parts oats, and 1 part bran, 1.5 pounds ...	*262	4.5	7.4	2.1	7.6–8.0	Few
Alfalfa hay, 2 pounds; mixture of 2 parts corn, 2 parts oats, and 1 part bran, 1.5 pounds	*290	4.61	20.0	1.45	8.3	Many
Alfalfa hay, 2 pounds; bluegrass, mixture of 3 parts oats and 1 part corn, 1.5 pounds	*350	4.51	29.3	1.69	8.1–8.8	Few
Corn silage, 2.5 pounds; mixture of 1 part corn and 3 parts oats, 1 pound ...	†118	4.30	0.10	1.69	7.3	None
Corn silage, 2.5 pounds; mixture of 3 parts oats and 1 part bran, 1.75 pounds ...	†178	6.96	0.9	1.01	6.8–8.0	Many
Corn silage, 1.2 pounds; clover hay, 1.6 pounds	†320	4.1	27.4	1.90	8.5	Solids not cr'ls
Rape pasture; mixture of 3 parts oats and 1 part corn, 2 pounds	*272	5.590	2.72	2.39	8.3	Many
Rape and bluegrass pasture; mixture of 3 parts corn and 1 part oats, 0.5 pound...	†410	5.41	2.72	2.54	7.8–8.6	Few

* In 12 hours. † In 24 hours.

COLLEGE OF AGRICULTURE AND APPLIED SCIENCE
LIBRARY
SEP 14 1932
MANHATTAN
KANSAS

This difference might not seem great enough to be significant, but it was noticed that when two pounds of grain were fed, the rape urine ash was neutralised, and the urine deposited crystals upon standing for several days. This indicates that the rape contained more calcium, magnesium, phosphate and silicate compounds than the bluegrass. The latter gave no crystal deposits when the urine stood in a flask for a month, and the addition of grain to the ration did not yield a neutral urine ash. On the contrary, 11 c.c. of 0.20 N HCl per 100 c.c. of urine were required to neutralise it. This alkalinity was due largely to the production of potassium carbonate in the formation of the ash material.

Alfalfa—Oat Ration.

When grain was fed with alfalfa hay in the proportion of two pounds of hay to 1.5 pounds of oats, 183 c.c. of urine per sheep were produced in twelve

XUM

hours. This urine had an average pH value of 8.2, contained 3.91 per cent. of solids, and 1.10 per cent. of ash. In this case the calcium, potassium and other bases of the alfalfa were more nearly neutralised by the phosphoric acid from the oats, and only 22.3 c.c. of 0.20 N HCl were required to neutralise the ash from a 100 c.c. sample. Two other sheep on the same ration produced 310 c.c. of urine each, which had the same pH value, and contained 3.7 per cent. of solids, and 1.26 per cent. of ash. The urine ash was less basic than before, and only 16.4 c.c. of 0.20 N HCl were required for the ash from a 100 c.c. sample.

The low percentage of solids (3.7 per cent.) in the urine would indicate an efficient utilisation of the food nutrients; besides, the alkalinity was not high enough to be irritating.

Oats, Corn, and Bluegrass Pasture Ration.

When bluegrass pasture was substituted for the alfalfa hay, and 1.5 pounds of grain (consisting of three parts oats and one part corn) were fed, the large quantity of potassium (K_2O), common to most pastures, averaged nearly half of the total ash content, yet gave the urine ash a less basic reaction than alfalfa and oats. The urine output was 330 c.c. per sheep in twenty-four hours, contained 3.91 per cent. total solids, 1.52 per cent. ash, and 11.0 c.c. of 0.20 N. HCl were required to neutralise the ash from 100 c.c. of urine.

Since the ash was quite water-soluble, it was hardly to be expected that calculi would be formed on a grain and bluegrass pasture ration. Reports from experienced sheepmen indicate that calculi rarely, if ever, form when bluegrass pasture constitutes an appreciable part of the ration.

Alfalfa, Grain, and Bran Ration.

When wheat bran is introduced into a ration it carries with it a large mineral content, especially phosphorus compounds. These readily form water-insoluble combinations with calcium, magnesium and aluminum, and gravel is deposited in the kidney and bladder, thereby often causing serious trouble to male sheep. The gravel tends to combine to form a conglomerate either in the kidneys, the ureters, the bladder, or the urethra, which makes it impossible for the urine to be voided. When bran is fed with alfalfa hay, deposits of calcium phosphate, ammonium oxalate, and aluminum phosphate, etc., form in the urine a few hours after it has been passed.

These crystals often have a definite structure, and are quite easily distinguished from the organic solids always present in urine. The crystals are heavier and readily settle to the bottom of the flask, whereas the organic debris stays in suspension longer, thus making it possible to obtain an estimate of the amount of each. When sheep are on pasture there is no evidence of such solids in the urine, but upon the addition of grain, especially wheat bran, even to a pasture ration, there will be a tendency for gravel to form when the urine stands a day or more. This was noticed especially in the case of sheep on rape pasture. As long as the sheep were kept on rape no crystals appeared in the urine, but when corn and oats

XUM

were given in addition, gravel formation was noticed in all samples. About half of the deposit was mineral material, chiefly calcium phosphate and aluminum silicate. This study of the relation between the urinary ash of sheep and different feeds is being continued for the purpose of finding a ration that will be most effective in preventing calculi formation.

Silage and Grain Ration.

When corn silage was fed with a grain mixture of corn and oats, the urine ash was nearly neutral. When alfalfa or clover hay was fed with silage and grain, the urine ash was more alkaline than when silage and grain were fed. When the ration consisted of mangels or alfalfa hay (Table I), the urine ash was strongly alkaline. Mangels have an effect on the reaction of the urine ash just the opposite to that of silage.

The reaction of the urine is further affected by the rate at which urease enzymes convert urea to ammonium salts. Williard has shown that the rate of crystal growth and the size of the crystals formed are affected by the rate of the urease reaction. When urea was used for this purpose instead of ammonium hydroxide, the precipitation was granular. The authors believe that their results warrant the hypothesis that the retention of urine in the bladder is conducive to the formation and growth of crystals. When the ration fed is composed of feeds which produce insoluble mineral compounds and is lacking in succulence, and when the atmospheric temperature is low, the urine becomes very concentrated, and is likely to be retained longer in the bladder. This gives urease sufficient time to form ammonium salts, which in turn increases the alkalinity of the urine to a point where certain insoluble compounds are precipitated. The crystals may become large enough to close the urinary tract.

Summary.

The replies received from a questionnaire sent to sheepmen indicate that the occurrence of calculi in sheep is fairly general in the United States, but is more frequent in some sections than in others.

Twelve positive cases of calculi were observed and studied by the writers, and 25 autopsies were performed. Post-mortem data on 219 lambs were obtained. Ten of these lambs had calculi.

Calculi were found in the kidneys, the ureters, the bladder, and the urethra, but in only a few cases were they found in all of these parts in the same sheep.

The calculi obtained and analysed were composed largely of calcium phosphate and organic matter. They varied widely in size and in degree of hardness.

Calculi were found more often in the processus urethræ (worm) than in any other part of the urinary tract. The S curvature of the urethra in male sheep offers a mechanical difficulty which frequently prevents the passage of calculi beyond this point. This is the place where large calculi are most likely to lodge and cause complete stoppage.

XUM

Partial or complete inability to urinate is the most positive symptom of calculi formation. When calculi are present the wool around the end of the sheath is invariably wet. In severe cases the back becomes arched because of the great effort required to urinate.

If the calculus is in the worm, and the worm is removed, recovery is rapid. The writers do not know of a successful method of dislodging large calculi from the S curvature of the urethra.

It was found that one attack was likely to be followed by a second or a third attack. In no instance did the animal survive the third attack.

Experiments were made to determine how different rations would affect the reaction or composition of urine. These experiments were conducted largely with wethers and ewes one year old and older, and covered a period of over two years. Forty-two different sheep were used, and 104 samples of urine were collected.

When roots were fed, 2,200 to 2,500 c.c. of urine per sheep were produced in twenty-four hours, whereas from sheep on dry feed the average production was only 200 to 250 c.c., but pasture increased this amount to about 600 c.c. per half day.

The reaction of the fresh urine varied from pH 6.8 to 9.0, depending on the feed of the animal. Sheep on alfalfa or beet rations produced a very basic urine ash, but when a cereal grain or bran was added to the ration the reaction of the urine was nearly neutral. The presence of the enzyme urease in urine also is responsible for it becoming basic rapidly upon standing due to the formation of ammonium carbonate from urea. This accounts for part of the large deposits of organic residues formed as the enzyme action continues making the urine much more basic.

When the ration was utilised to best advantage by the sheep, about 3 per cent. of solids were found in the urine. On the most undesirable rations the sheep produced a urine containing 6 to 8 per cent. of solids, which indicates a large waste of nutrient material. Moreover, the urine ash was highly basic. It seems probable that such urine would irritate the urinary tract, and thus account for the observed cases of marked inflammation of the urethra in the absence of calculi. When sheep were fed alfalfa or clover hay, or roots alone, a highly basic urine was produced.

Certain mineral compounds are sometimes precipitated from the urine, and the crystals cluster around an organic nucleus, which results in the formation of calculi.

The nature of the urine affords an important guide to the utilisation of a feed, and has a notable effect on the production of calculi.

REFERENCES.

(1) Easterfield, T. H., Rigg, T., Askew, H. O., and Bruce, J. A. 1929: "A Widespread Occurrence of Xanthin Calculi in Sheep," *Jour. Agr. Sci.* (England) 19; [573]–585, illus.

(2) Evvard, J. M., Culbertson, C. C., and Wallace, Q. W. 1923. "Cane and Beet Molasses for Fattening Lambs." *Iowa Agr. Expt. Sta. Bul.* 215, p. 369–400, illus.

XUM

(3) Fujimaki, Y. (1927): "Formation of Urinary and Bile Duct Calculi in Animals Fed on Experimental Rations, with a Short Note on Treatment," *Japan. Med. World*, 6; 29–35, illus.
(4) Hager, B. H., and Magath, T. B. (1925): "The Ætiology of Incrusted Cystitis with Alkaline Urine," *Jour. Amer. Med. Assoc.*, 85, 1,352–1355.
(5) Hager, B. H., and Magath, T. B. (1926): "Four Cases of Urinary Calculi from which Proteus Ammoniæ was Isolated," *Med. Clin. No. Amer.* 10, 693–702, illus.
(6) Hager, B. H., and Magath, T. B. (1928): "The Formation of Vesical Calculi," *Jour. Amer. Med. Assoc.*, 90, 266–272, illus.
(7) Keyser, L. D. (1923): "The Ætiology of Urinary Lithiasis: An Experimental Study," *Arch. Surg.* 6, [525]–553, illus.
(8) McCarrison, R. (1927): "The Experimental Production of Stone in the Bladder," *Indian Med. Research* 15, 197–205, illus. (Also published in *Brit. Med. Jour.* (1927), 1, 717–718, illus).
(9) Marcet, A. (1817): "An Essay on the Chemical History and Medical Treatment of Calculous Disorders," p. 181, illus., London.
(10) Michael, L. G. (1910): "The Influence of Feeding Sugar Beets and Mangels to Breeding Animals, with Special Reference to the Formation of Renal and Urinary Calculi," *Iowa Agr. Expt. Sta. Bul.*, 112, p. 77, illus.
(11) Osborne, T. B., and Mendel, L. B. (1917): "The Incidence of Phosphatic Urinary Calculi in Rats Fed on Experimental Rations." *Jour. Amer. Med. Assoc.*, 69, 32–33.
(12) Sisson, S. (1917): "The Anatomy of the Domestic Animals." Ed. 2, p. 930, illus. Philadelphia and London.
(13) Tennant, C. E. (1923): "Cystin Calculi: A Complex Surgical Problem." *Jour. Amer. Med. Assoc.*, 80, 305–307, illus.
(14) Youatt, W. (1893): "The Complete Grazier and Farmers' and Cattle-Breeders' Assistant." Ed. 13, re-written, considerably enlarged, by W. Fream, p. 1,086., illus. London.

Clinical Articles

Two Unusual Canine Cases Treated with Apomorphine.

By N. MACDONALD, M.R.C.V.S.

Altrincham.

THE subject was a three-months-old terrier pup, which was playing about while his master was doing some repairs to his car. When the job was practically finished the owner missed a nut from the car, and being unable to find it, concluded that the pup had swallowed it. He immediately brought the dog in and reported what had occurred. The animal was quite bright and happy, but on palpating the abdomen I was suspicious of a foreign body being present. Apomorphine, gr. 1/30, was given hypodermically, and in five minutes emesis commenced. On the third attempt the pup vomited a nut which was found to be 1 in. in diameter. After several more bouts of vomiting the animal was quite all right. The surprising part was how so small a pup succeeded in swallowing so large an object and vomiting it again without any apparent discomfort or injury to the œsophageal tract.

Another case was a seven-months-old Irish terrier dog owned by a lady who runs a ladies' hairdressing establishment. The history was that at 1 p.m. that day the dog had been left alone in the hairdressing saloon, and on returning in

XUM

five minutes the owner found him on the floor with a box of rubber discs, the size of a penny, with a central hole, which are used in permanent-waving machines. There were forty-eight discs in the box originally, only two of which were left, the dog having swallowed the other forty-six. The dog was brought in at 8 p.m., and he appeared quite normal. Palpation revealed a full stomach, but the owner said the dog had had a meal an hour previous ; no foreign matter could be definitely located. Apomorphine, gr. 1/20, was given, and in a few minutes the dog started to be sick. He vomited about eight times, and forty-five rubber discs were recovered, all in perfect condition, except for three which had been partly chewed. The owner stated that on two other occasions the dog had been seen to swallow one of these discs, and had passed it later in the motion. I was rather surprised that these discs should remain in the stomach over a period of seven hours, when it is obvious that they could pass through the pyloric sphincter, as one of them must have done. Surely this is rather a long period of time for a " meal " to remain in the stomach. Incidentally the dog was quite all right, and ate a meal two hours afterwards. In this latter case half an ounce of liquid paraffin was given five minutes before the apomorphine, with the idea of lubricating the œsophagus and facilitating vomition.

Sodium Phenobarbitone as an Antidote for Strychnine Poisoning.

By J. DOWLING ALLMAN, M.P.S.

FROM the experiments of H. W. Haggard and L. A. Greenbergh (*J. Amer. Med. Assn.*, April, 1932, 1,133, through *Pharm. Journal*, May 7th, 373). Sodium phenobarbitone should be a useful addition to veterinary therapy as an antidote for poisoning in dogs and cats that accidentally get poisoned by picking up birds or rabbits which have been poisoned by strychnine. Haggard and Greenbergh carried out a number of experiments in the hope of discovering a more ready and effective method of treating poisoning by strychnine than the use of emetics, stomach tube, and volatile anæsthetics. From their investigations they found a true antagonism between the action of sodium phenobarbitone and strychnine. Rats and dogs that received three times the lethal dose of the sodium compound were saved by the administration of amounts of strychnine which by themselves would have been fatal.

Phenobarbital.

Phenyl-ethyl barbituric acid, known under the name of luminal, is largely employed in medical practice in the treatment of epilepsy as a hypnotic. The drug is allied to veronal, and, like most sedatives, will reduce the number of convulsions in epileptics if given in maximum doses of gr. 1½ to 3 grains. For veterinary therapy the sodium salt must be used, as it is soluble in water, but its sister salt, phenobarbital (luminal), is not. The most useful and ready mode

XUM

for the veterinarian is to have some tablets of the monosodium salt made, each tablet containing three grains; these are readily soluble in water, and are ready in cases of emergency in strychnine poisoning. If the convulsions are frequent, and the jaws locked, the drug can be used hypodermically instead of by the mouth.

P.S.—The tablets, 1½ and 3 grains, can be had from C. J. Hewlett and Son, Ltd., 35-42, Charlotte Street, E.C.

Abstracts of Current Literature

Obstructed Teats.—By Dr. F. Burki, *Veterinary Surgeon, Stettlen. Schweizer Archiv. f. Tierheilkunde.* Vol. 67. No. 19.

Congenital stenosis of the teat consists in most cases of an obstruction at the base of the teat. The milk cistern and teat canal are not stenosed, but the natural narrowing of the milk ducts in the cistern is quite closed at the base. This form of closure is unfavourable from an operative point of view owing to the numerous blood vessels at the part, and severe hæmorrhage which may arise at the point of incision; and the coagulated blood is difficult to milk out from the weak and narrow cistern, and immediate clotting and reclosure at the operated place occurs.

More rarely congenital stenosis arises as a slight growth of the teat canal opening, atresia congenitalis, just as other congenital closures of natural body openings. Operatively these cases are generally favourable, because by mere penetration or slitting any considerable injury to the teat canal can be avoided. Such forms I have frequently operated on successfully. But the most frequent kind of teat stenosis is the traumatic. The varied causes produce different degrees of stenosis. They may consist of a chronic tearing and crushing, an accidental contusion, with or without external teat injury in rents or lacerations of the teat or udder, conjoined with more or less severe thelitis or mastitis. The customary form of "drawn-down flesh," so-called by the milkers, consists in nodules of the mucosa of the cistern. They may be immovable, stalked, or directly floating into the cistern, and of pin-point, pea, or cherry size.

Another frequent form is similar to the above, but with this difference: that the nodule is situated in the under part of the cistern or in the teat canal itself. Both forms may be caused by unnatural milking, although the latter is more frequently caused by an actual trauma. By natural milking, I mean a reproduction of the calf's action. The teat is seized by the calf in the spoon-like hollowed tongue, pressed against the hard gums, which produces the sucking movements, consisting of a commencing draw, followed by a pressure movement. The pressure movements must be more intensive than the drawing movements, because the teat is never let go, and not being seized again at each fresh pull, the drawing movement is very short. The bad milker seizes the teat half way up, or higher, and with each draw the fingers slip down to the teat point, and for each

XUM

stream of milk a fresh grasp has to be taken. The hand of the good milker makes no great movement. A proof that this bad kind of milking produces teat stenosis is that these were very prevalent during the War, when women and boys unaccustomed to milking were largely employed. Inflammations, indurations, and proliferations frequently arose. The bad milker frequently develops an abnormally large keloid on the thumb which injures the teat lining when in action. Apart from these, old milkers sometimes do not possess the necessary power for natural milking when they have milked all their life, and so the cow is not properly milked out, and mastitis arises.

As the most frequent cause of accidental traumatic teat stenosis, a tread by a neighbouring cow may be declared. The injury mostly occurs at the teat end, distal third, or at the highest in the lower half of the teat. The wounds are more or less deep, mostly sharply defined, often as if cut with a knife, so that the owner many times suspects a malicious injury. But I believe that this sharply defined wound is due in most cases to the sharp edge of the claw direct, or on the concentric layer of the teat tissue, or is brought about by the hydraulic counter pressure of the more or less filled cistern (spring effect). A not less frequent form of traumatic thelitis occurs from external injuries, as I have noticed several times, from crushing by the hock-joint of the animal concerned. Especially does this occur in new milking cows. As a result of springing and udder œdema, the teats stand out stiffly in large tense udders, so that in lying down they easily become crushed. Good milkers often suffer from rheumatic osteomalaciac affections, or chronic ulcers of the sole, so that they are decumbent more than usual, so that without rising, except only on their forelimbs, they turn over on their belly, udder, and hind limbs. Thus a crushing of the teats very easily occurs.

All these forms are unfavourable or doubtful for operation. Principally, as long as there is swelling of the teat or general thelitis they should not be operated on. A moderate experience shows that such traumatic teat stenoses heal without operative interference, and that inflammatory processes and swelling of the teat cistern and canal decline under the influence of anodyne and antiseptic ointments. Where the stenosis is so severe that no milk or only a drop can be drawn for two to four days, one has to assure the anxious owner that the highly inflamed tissue cannot be operated on, and that a relief of the stenosis will occur after the inflammatory process declines. The introduction of milk tubes, needles, or bougies at this time is contra-indicated, and may lead to general infection and death of the animal.

I believe, and have the testimony of owners, that the amount of milk secretion is not absolutely proportional to the number of teats. Although each quarter possesses its own gland tissue and supplying zone, there is no anatomical partition between quarters on the same side, so that in all cases a flowing out from one-quarter to the other is feasible. Generally the stenosed quarter in each new lactation becomes normal, like the other quarter, but soon goes back again spontaneously and atrophies. But the loss of milk may be partly compensated for

XUM

by increased activity of the remaining quarter, as is proved also in the case of other dual glands (kidneys, ovaries, testicles). I know of a case in a very good milch cow which, through stenosis, successively lost two quarters, and yet gave one and three-quarter gallons of milk at each milking; and it even calved again as a two-teated cow.

A three-teated cow is sold at a diminished value, but quantitatively it does not give much less milk, so that the owner does not often have it treated for stenosis. The one-sided quarter many times delivers so much milk that it can quite well be milked out with the two other quarters without the milk being disagreeably influenced. A teat stenosis frequently occurs in the dry stage through oblique or horizontal septæ occurring in the cistern. If the membrane is at three-quarters the length of the teat, the stenosis may be remedied by cutting through with the lancet, because the open teat canal is scarcely injured by so doing. But in dry cows with narrow cisterns and thick teat walls, the stenosis is high up, and they cannot be dealt with for the new lactation period. Such stenoses are best left alone, and all stenoses in thick-walled teats are unfavourable, for the milk only flows weakly or not at all, and a stenosis can or must easily occur again.

A frequent cause of teat stenosis is udder pocks. These develop chiefly on the teats or teat ends, and often directly on the teat canal orifice. After eruption of the vesicle, the resultant scab often stops up the teat canal, and this is picked off each time by the milker, so that the milk may be drawn. Through the repeated lesion healing is hindered, the inflammation attacks the teat canal and leads to a thelitis, or often also to mastitis, especially if the milker seeks to remedy the stenosis himself. The general inflammation of the test canal and the cistern leads to a complete stenosis and closure. A not infrequent cause of teat stenosis in young cattle are the frequently occurring papillomas. Luckily many cases of almost innumerable warts disappear before the setting in of lactation, and if the teat canal and teat point is affected with papilloma, one must seek to remove it. Through incautious ligaturing or erosion of the wart complete stenosis may occur. I once saw such a thorough " treatment " that the ends of two teats were completely eaten away, and on a third the teat canal was eroded. A successful opening of such cicatricial tissue is hopeless. As rare causes of teat stenosis, I have noticed rabbit bites. These, through advancing injury of the teat canal, lead to total obstruction. I have only noticed transient stenosis in foot-and-mouth disease, because the teat canal remains intact (relatively acute course, no interference by the milker). All stenoses with inflammation should only be slightly or not at all operated on, for the object of the operation (to make milking possible) results in very many cases in only an aggravation of the disease processes. A hint was given to me by a poor woman by which procedure cases might be successfully operated on.

A prime milking goat cut the whole length of one teat with a thorn. The cistern was wide open, so that the milk flowed away from the gaping wound. Luckily the distal end of the wound was lateral, so that the short teat canal

XUM

remained intact. I closed the teat wound with a continuous suture, and was greatly astonished to find *per primam* healing at the end of eight days. On my questioning, the little mother proudly declared: "Until the wound was healed I simply sucked the milk out." This is an example, however, that can hardly be followed.

The Consideration of Vitamin in the Feeding of Cattle.—By District Veterinary Surgeon R. W. KOPPITZ, of Jagerndorf. *Prager Archiv. f. Tiermed.* Part B. No. 8. Ninth Year.

VITAMIN, which in recent times has been recognised as a special substance, has previously been instinctively considered as giving to food its palatability and adequacy. Modern tests have experimentally proved that vitamin is capable of making valuable improvement in different directions on the animal organism. We recognise four kinds of vitamins: vitamin A, as furthering growth; vitamin B, as lacto-vitamin, increasing milk production; vitamin C, as hindering keratomycosis, which declares itself in hens by nasal catarrh, inflammation, deposits with small yellow pustules on the mucosa, on the œsophagus, and air cavities; vitamin D, as antirachitic, affecting the regulation of the calcium content of the organism.

For cattle, vitamins A, B and D are of importance, since these further growth and milk production, and hinder softening of bone. Vitamins in food, however, are not, according to their kind and content, to be made plainly analogous to nutrient values as given in food tables, but the recognition of their existence has shown by practical observation that they give palatability and suitability to foodstuffs, and health, productive capacity and good condition thereby to the animals.

To make his holding rentable, the cow-keeper has to study his feeding with keenness and care. Even the small husbandman considers not only the food value of his rations, but also its palatability and desirability to the animal: vitamins in the food will furnish these conditions. In my many years' veterinary practice in large establishments (sugar factories, distilleries, dairies) with intensive fattening and milk production, opportunity has been given me to test and examine and choose foodstuffs, and gain rich experience.

As regards food groups, those rich in vitamin may be named first. With respect to green food (the young grasses of the pasture are the richest in vitamin), field and meadow grasses in flowering time, the clovers (especially red and white clover), lucerne and rye grass, leguminosæ, green rye, green maize, etc. Of rough or dry fodder, meadow clover and mixed hay have great vitamin content, as also summer straw with rich grass and clover bottom. The winter straw, very fibrous and brittle, had scarcely any food value. Of corn foods, fed as crushed, cracked bran or meal, beans, maize, rye, oats, wheat, barley, and in all cases vetches (for fattening), are rich in vitamins and albumen. Of the

XUM

tubers, mangolds and carrots may be mentioned as rich in vitamin content, also swedes and turnips. Potatoes, raw or cooked, are rich in starch, but poor in vitamin.

In agricultural industry operations, the residue of maize starch manufacture; in corn distilleries, the wash; in breweries, the malt culms and grains, are all rich in vitamin. Waste from potato distilleries, and residues in the manufacture of starch from potatoes are not useful. Silage is rich in vitamins as made from green fodder grass, clover, turnip tops; and fermentation makes it a palatable fodder. The various oil cakes (sun-flower, linseed, earth nut, palm kernel, coconut and rape, the last only for fattening), are not only rich in albumen, but also in vitamins; used alone, or as a mixture with soya bean meal, carefully stored, they are very valuable.

Molasses and sugar feeds contain vitamin and albumen in proportion to the mixing of the molasses from barley, oats, malt culms, or dry husks, but these are of considerably less value as food adjuncts than flesh, fish, or blood meal: the latter have an exceptionally high albumen content, but no vitamin. For the vitamins it must be said that these are as important for the life, growth, and health of the animal as albumen, fat and starch, vegetable fibre and mineral constituents.

As a proof of this, the year 1928, with its drought and failure of vitamins in fodder plants, may be cited. The hay harvest was only a third of normal, and not sufficient could be fed to the cattle, and as a result the necessary vitamin failed. The straw was fibrous and of less value, the roots diminished in size, the potatoes not ripe, in many cases frozen in the winter, and scarcely usable as food; also the concentrated foods were of poor quality. Lack of food and failure of vitamins occasioned much sickness. Under-nourishment, dejection, weak condition, constant lying and abortion, caused much damage. Improvement could only be brought about by food rich in vitamins, such as hay, oil cakes in the form of sunflower, earth nut, palm kernel, and coconut cake being added to the concentrated food. Animals so treated not only recovered, but quickly came into better condition, and milk supply improved, and the whole herd benefited. In cases where oil cakes were used during the winter period, condition and milk supply remained good, and damage was avoided.

It may be said that without vitamins there is no thriving, no growth, no good milk production, and no life. Therefore in feeding, not only the nutrient value, but the vitamin content of the feeds should also be considered.

Therapy in Stuttgart Disease.—By RUDOLF, M.D., and MENDAL, Ph.D. *B.T.W.*, July 3rd, 1931. No. 27.

REFERENCES to treatment of canine typhus in literature make one rather sceptical. Lange carried out symptomatic treatment without much success; Mikuscha had 67 cures out of 168 cases with staphyloyatren; Keszler and Börensen

XUM

conducted trials with pallicid; Gutmann employed physiological salt solution with good success. Jordanoff recommends introcid intravenously, and also medical and dietetic treatment; he has had good success this way. He recommends in addition withdrawal of water, which in our experience acts unfavourably. Rife is of the same opinion. Glass stresses dietetic treatment with green vegetables. Presch upholds the therapeutic value of pallicid, and notes non-success with electrocollargol; the mortality, in spite of treatment, reached 60–80 per cent. Hutyra and Marek refer to methods of treatment besides those mentioned, and give prior place to percutaneous ichthargan therapy, according to Bass, and recommend beside acidulated water and meat-free diet.

As a result of our experience in infectious gastro-intestinal maladies and a large and long dealing with the breeding of dogs, and their diet in sickness and health, we have worked out a therapy which has brought to us about 100 per cent. of success. We should like to declare that results do not depend on the medication alone, but it must be given in the prescribed form and dosage, and be combined strictly with the prescribed diet and living régime. The medicine alone, indeed, brings improvement, but no certain cure, at least not in severe cases. We recommend in this connection magnesium-perhydrol (Merck), and best in tablet form (a powder form is available, but the tablets are handiest) in large daily doses, but in as small single doses as possible (the more severe the case the smaller and more frequent the single dose of the drug), 0.5 to 2 grammes = 1 to 4 tablets, five to ten times daily; in severe nervous forms without inclination to vomit, double and treble this amount if possible. Medication is given at equal intervals of time, smaller and smaller doses in a tendency to vomit, and at lesser intervals, but in every case a tablet every half-hour. Up to now no case has been encountered where the vomition was not checked in this way. But in every case this symptom furnishes the severest complication to the proposed therapy. The medicine produces its effect surprisingly quickly: one sees a few hours after the first dosing—often before the first evacuation of the bowels—disappearance of the paralysis and staggering symptoms, awakening appetite, even sudden eager desire for food (caution, diet). Other medicine is superfluous. At first we used animal charcoal internally, or as an injection, but found that no material benefit arose from its use. One case where osinotherapy (physiological salt solution) was used, in addition to the treatment described, did well.

Feeding.—Raw beef, finely chopped, absolutely fat free, of the best quality, in the smallest possible quantity, and in single doses as frequently as possible in the intervals between dosing, never at the same time. The larger number of patients take this food eagerly and willingly after the first magnesium-perhydrol doses. In this case, in the first few days of illness, give no other food. Above all, at the same time the need for fluid must be gratified. At best, raw, pure milk, or tea with milk, or, if need be, tea. If these fluids are not taken, pure unboiled water may be given frequently in small quantities. The animals take

XUM

it willingly, and in our experience it is pressingly necessary that the polydipsia displayed need of fluid for the system be assuaged. It leads apparently to polyuria and to intensive flushing out of toxins. Some of the animals, apparently as a result of difficulty in swallowing, would not take this diet at first. In these cases we spooned nourishment into them, such as milk with tea, and yolk of egg and milk, in each case with sugar, until the appetite returned. Little and often here also. About a day's quantity at the time of severe illness for a 60 lb. dog is 1 lb. of raw meat, or $1\frac{3}{4}$ pints of milk, plus two to four egg yolks. Where milk is refused and meat taken, water up to $1\frac{3}{4}$ to $2\frac{1}{2}$ pints may be given. In cases varying in severity, give either magnesium-perhydrol, or a small quantity of food or a few meat pills and some fluid where appetite is present, and in the case of refusal of food, milk, or milk-tea poured cautiously through the lips. In advancing recovery, slowly and gradually increase the food and the food intervals. Even after the second to fourth day of illness, cooked lean meat may be given, or meat fried in butter, milk foods and thin white bread and butter. Recovering animals frequently refuse raw meat after a day or two.

Quarters and Bedding.—Warm and dry. To prevent chill, it is recommended to put a warm coat on the dog. A feverish dog should not lie on the cold ground. A mattress of straw to be on is advisable. A little basket or box, and in the cool time of the year a warmed room. Therapy must be gradually and cautiously and little by little discontinued. Four to six weeks after recovery, extreme care in feeding is necessary (five meals daily, avoidance of fat, fresh good food, greatest care against a chill or over-feeding).

A List of the Cases.

Table I.

	Under 1 year.	Under 2 years.	Over 2 years.
Thirty gastro-intestinal	11	14	5
Seven nervous	2	4	1
Seven mixed form	3	3	1
Forty-four	16	21	7

Table II.

	Together.	Gastro-intestinal.	Nervous	Mixed.
Outbreak, 1921 ...	13	7	3	3
Interval	6	3	3	—
Outbreak, 1930 ...	25	20	1	4
Total ...	44	7	7	7

XUM

Treatment of Tetanus by Sera-Therapy under General Anæsthesia. —By R. Le Clerc, *La Presse Médicale*, January 24th, 1931. Ex *Revue Générale de Médecine Vétérinaire*, May 15th, 1931.

Numerous observations of the cure of tetanus by sero-therapy associated with general anæsthesia have been published recently since the initial report of H. Dufour and Duhamel.

This therapeutic method is the last one evolved in the treatment of tetanus. Anæsthetics have been at first utilised to overcome the tetanic spasms, and to allow of an injection of serum otherwise difficult; the results obtained have led to the supposition that the serum was better used out under anæsthesia than in ordinary serotherapy. H. Dufour has expressed the view that in favour of chloroform the nervous tissue charged with toxin is better influenced by serum as a result of the disturbances brought about by anæsthesia. If the results are favourable, the mode of action is far from being determined, seeing that certain observers attribute the efficacy of the treatment to the fact that the administration of the serum is intra-rachidean; others alternate anæsthesia and serum; whilst some others maintain the ailing animal in a prolonged anæsthetic sleep.

R. Le Clerc endeavours to clear up the mechanism of the pathologic physiology of this therapy by studying the conflict of the presence of two neurotropic substances—toxin and anæsthetic. These researches follow the lines of the experience of Wassermann and Takaki on the fixation of the tetanic toxin by pounded (bruised) nervous substance. Marie and Tiffeneau had already shown that the addition of alcohol or ether to the neutral nervous toxin substance causes it to recover its toxicity.

Le Clerc has repeated these experiences by injecting, not the neutralised mixture, but the supernatent liquid. In a first test the liquid separated from a neutral mixture did not give tetanus to a mouse. If one added ether, chloroform, or ethyl chloride, toxin is liberated, and the supernatent liquid caused tetanus in the mouse. It is probable that the anæsthetics, by fixing themselves on the lipoids of the brain, dislodge the toxin, and this being liberated is more easily destroyed by the antitoxic serum. For this phenomenon of displacement of the toxin, Le Clerc suggests the name of *toxelase*.

The facts published up to now constitute a sufficient basis for reviewing and revising the therapy of tetanus, and using etherisation and chloroformisation associated intimately with specific serotherapy. The antitetanic serum should be injected in big doses before, during, and after a general anæsthesia of at least half an hour. For example, in man, 60 c.c. quarter of an hour before, 80 c.c. during, and 60 c.c. a quarter of an hour after, anæsthesia, and that once or twice each day according to the gravity of the case. As regards choice of an anæsthetic, it seems to ether rather than chloroform that one ought to give preference, whilst awaiting the results furnished by protoxyde of azote or other anæsthetics. Ether is certainly the more active *in vitro*; but clinical considerations, drawn from the state

XUM

of the lungs for example, might make one prefer chloroform. Injections of serum (made before, during, and after anæsthesia) ought to be as usual—sub-cutaneous, intramuscular, even intravenous. The intra-rachidean injection, until proved to the contrary, does not appear to offer any advantage, and there is a risk in all cases, if one repeats it, of causing seric meningitis.

Observations on an Epizootic of Contagious Ecthyma of the Lips in Sheep. —By. M. HATZIOLOS. *Revue Générale de Médecine Vétérinaire*, May, 1930.

CONTAGIOUS ecthyma of the lips causes great losses in the ovine population of Greece. Contagiousness was very marked and such as to lead some to think it might be aphthous fever. Goats remained free from the malady. Clinical symptoms were chiefly the usual buccal and podal ones, the venereal form was quite rare. Contagion to man was sometimes observed. Treatment of a symptomatic kind and isolation failed to arrest the epizootic, and the author used vaccination according to Moussu. Crusts, pus, and blood from an affected animal were pounded in a mortar and mixed with double the quantity of tepid boiled water; after filtration through cotton wool, 30 c.c. of the virulent material is added to 70 c.c. of pure glycerine. This vaccine is inoculated by scarifications of the skin at the internal surface of the thigh.

This affection of sheep has been known for a long time, probably since sheep have been put on the stubbles. The hard stubbles cause slight injuries to the susceptible lips, and these get infected by moulds on the weeds and grasses. In a man affected, small nodules form on the hands, ulcerate in three or four days, and heal up in about ten days (Oppermann). At times this lip disease is accompanied by leg ulceration and nodules and ulceration on the genital organs of ewes and rams. Armstrong calls it pustular inflammation of the skin, and classes it as ecthyma; Oppermann designates it impetigo, and due to the necrosis bacillus; Hutyra and Marek, impetigo or ecthyma.

Pisgoed or Pisgras.—By D. G. STEYN. *Sixteenth Report of the Director of Veterinary Services, Pretoria*, August, 1930, p. 417.

FOR a long time here sheep have occasionally been affected with a malady causing inability to pass urine. It is named "Pisgras," and is attributed to *Euphorbia genistoides*. The malady was observed in a flock of 400 sheep, and ten had died. A humid atmosphere and warm time of the year favoured the extension of the complaint, which was characterised by redness and infiltration of the part of the prepuce in contact with the wool. The inflammation may attack the sheath, and become very painful; it hinders the flow of urine, which lodges in the sheath. Small vesicles filled with a clear liquid pass on into pustules, which on bursting leave ulcers. A yellow pus of bad odour accumulates in the distended and inflamed sheath. No test as to the action of euphorbia has been carried out here. Treatment is as follows: Cut the wool away from the extremity

XUM

of the prepuce ; remove the crusts or scabs, and cover the region with a 1 in 10 carbolic ointment. When the inflammation has gained the sheath use repeated injections of an antiseptic oil. [This disease, with pustules and ulceration of the prepuce, may be due to the bacillus of necrosis, and be classed as impetigo or ecthyma. Sometimes it is said there is swelling and ulceration of the vulva, and a muco-purulent discharge from the vagina of ewes.—*Trans.*]

" Studies on the Paralysis of Fowls." By Messrs. EMOTO and MIYAMOTO. *Journal of Japanese Soc. of Veterinary Science*, December, 1930, ex *Revue Vétérinaire*, October, 1931.

THIS malady, which chiefly affects the peripheral nerves and the eyes, is described under the name of paralysis of fowls, for want of a more satisfactory designation. It is an affection which, without an apparent particular cause, produces an asymmetrical paralysis, partial and progressive, of the wings and the feet, or a contraction of the pupil, with grey discoloration of the iris ; it attacks poultry of all breeds, and especially those a year old. Feeding has no part in its ætiology, and the appetite remains without change from the beginning to the end of the malady. Neither coccidiosis nor intestinal worms are responsible. The mortality may be 60 per cent. or more. The principal lesions are situated in the nervous system and in the eye ; they consist at first in an intense infiltration of white globules of large mononuclear and eosinophile cells ; and as a result there is degeneration of the marrow, and gradual atrophy. In chronic cases the nerves and the eye are invaded with conjunctive tissue.

STATE COLLEGE OF AGRICULTURE AND APPLIED SCIENCE
LIBRARY
SEP 14 1932
MANHATTAN
KANSAS

Obituary

PROFESSOR DR. M. BURGI.

PROFESSOR DR. M. BURGI, Director of the Swiss Federal Veterinary Service, died recently. He was only fifty-four years of age. His thesis for the doctorate was on " Staphylomycosis in the Hare." In 1906 he was a private tutor on anatomy, embryology and histology for the Veterinary School in Bern. In 1918 he was appointed Professor of Meat Inspection. From 1914 to 1918 he administered the special regulations made during the War in connection with the trade in meat and its care. He took part in many researches and investigations into diseases, such as coital exanthema in Alsace, rinderpest in Belgium, bee diseases, official control of sera and vaccines for veterinary use, measures against abortus-Bang, preparation of measures for State support in combating tuberculosis of cattle. He took park in many international veterinary congresses. He was elected an Honorary Associate of the R.C.V.S. in 1930. He was highly esteemed as a man, being just in his decisions, and staunch in his friendships.

XUM

XUM